THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Co-operative Power Supply on the Farm	853
Mr. Kellaway and a Directorship	854
The British Empire Exhibition	854
The Electrical Section of the Exhibition	854
Guaranteed Loans for Electrical Undertakings	854
Unemployment Insurance and the Electric Supply Industry	855
South African Industries	855
Industrial Relations	855
Hydro-electric Development in Tasmania, by Fred. A. Talbot (*illus.*)	856
Salesmanship in Engineering	858
Application of Electricity to Agriculture, by Borlase Matthews	859
Electrical Possibilities in Ireland	861
Salesmanship in the Electrical Industry	862
The Electrical Trades Benevolent Institution	862
Legal...	863
Correspondence—	
Shift Engineers' Salaries	863
The "Standard" Brush-holder	863
Estimating for Internal Wiring Contracts	864
Electric Lighting, Heating, and Cooking	864
The Hastings Electricity Undertaking	864
Steam-condensing Plant	865
The Improvement of Power Factor	865
Applications to Box Numbers	865
Business Notes	866
Notes...	872
City Notes	876
Stocks and Shares	877
Causes of Transformer Failures, by S. Austen Stigant (*concluded*)	879
South African Trade and Industry	881
Domestic Load Building, by W. A. Gillott (*illus.*)	882
The New Colwyn Bay System	884
Exports and Imports of Electrical Goods and Machinery for October, 1922	885
Parliamentary Notes	885
Electrical Christmas Gifts (*illus.*)	886
The Institution of Electrical Engineers...	887
New Patents	888
Published Specifications	888
Contractors' Column ... ... Advertisement page xxviii	

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CO-OPERATIVE POWER SUPPLY ON THE FARM.

THE French agriculturist, so often quoted as an example of energy and thrift, appears to be turning his attention to the use of electric power with that coldly logical outlook for which his nation is renowned. The recognised difficulty of providing a ramification of h.p. lines and hundreds of services to scattered farms he is endeavouring to overcome by securing the farmer as a shareholder before he becomes a consumer.

A leaflet has been issued by a company which is being formed to merge the principal power suppliers of the Sarthe district, in which the case for electricity in farm and field is set out clearly; the first essential, an extensive network reaching every district and village, is to be achieved by the help of those who will employ it and who are now asked to invest in the company, securing a safe outlet for their spare capital and helping to bring to themselves and others the benefits of power and to replace or supplement the hand labour now so much more difficult to obtain and pay for. It is of interest to note that in these French proposals the basis prices suggested for the supply are high relatively to figures usually contemplated in this country, being 1 fr. for power and 1 fr. 80 c. for lighting.

In connection with the provision of electricity supply for agriculture and village work, it is desirable that electrical engineers should give careful consideration to the question of basis price; in so many cases we hear that these widespread supplies cannot be given on account of the high cost of distribution, but it is to be feared that this view arises from the difficulty which the English electrical engineer finds in contemplating rates for rural supply very much higher than those to which he is accustomed in the town.

Our business has been built up in active competition with coal and gas, and we have been so accustomed to regard the prices of 1d. to 2d. per kWh as about the right thing for power that we find it difficult to realise that in isolated districts, in villages, and on farms, figures of 6d. or 8d. per kWh may be quite satisfactory for a supply of electric power, and twice as much may be obtained for electric lighting.

It must not be forgotten that in these isolated districts it may well be electric power or nothing, or, at the best, an oil engine with all its attendant troubles, due to weight, fire risk, &c. One has only to consider the cost of electric power per unit of output, as in the thrashing of corn, cutting of roots, and similar work, to see that it is not only unnecessary to quote very low rates for scattered supplies, but that to do so would probably deprive the agriculturist of the benefits of electricity supply altogether.

The French circular draws some interesting comparisons between the costs of man and animal power, putting down, for example, the energy output of a well-cared-for horse at something like 2½ kWh for five hours of steady working, and the energy output of a man at a very much lower figure. Naturally these comparisons are of small direct value owing to the immense difference between the combination of intelligence and flexibility which one gets from man or animal as compared with any kind of machine, but nevertheless they show in a most striking manner how the value of the man can be enhanced if aided by the machine, and there is obviously call for study of the whole subject by the British electrical engineer and for the production of suitable propaganda and advertising treatment for the agriculturist and village resident.

The subject has already been tackled in its usual popular manner by the Electrical Development Association, and it is much to be hoped that the prospects of business of this kind may not be spoiled by too hasty an assumption that relatively high rates cannot be obtained for the supply.

At least one technical problem arises in this connection: the makers of transformers and switchgear might well study the question of tapping high-pressure lines for small amounts of energy with economy and safety. To take from an overhead or underground main small parcels of power, perhaps 10 to 50 kW, is apt to be expensive if the security of the supply is carefully considered, and in this connection there is probably room for a good deal of improvement without descending to the very elementary methods which one sees in vogue in foreign countries.

Mr. Kellaway and a Directorship.

We have no desire whatever to discuss the nature of the part taken by Mr. Kellaway as Postmaster-General in any negotiations with the Marconi Co. that arose during his term of office. That matter has formed the subject of questions in Parliament, and Mr. Kellaway has sent to the newspaper Press copies of a communication that he has addressed to Mr. Bonar Law on that aspect of the affair. Whether there were or were not negotiations does not affect our judgment of the case. It has been common knowledge that for many years there have been outstanding claims against the Post Office, and we, with others, have urged that some settlement ought to be arrived at without any further delay. We wish that they could have been finally settled before the late Government went out of office, so that Mr. Kellaway could have joined the Marconi board after all differences had been cleared up. Events, however, were against such a course. We have not a word to say against Mr. Kellaway as a man of honour and uprightness, yet we would rather that any Postmaster-General of recent years had seen fit to decline the directorship in question, at any rate for a time, however excellent his business qualifications for such a post might be. In the event of its falling to the new Postmaster-General to endeavour to arrive at a final settlement, will his position be rendered easier or more difficult because on the other side his predecessor in office (who cannot divest himself of inner knowledge acquired as Postmaster) is, as a director, a party to such settlement?

The British Empire Exhibition.

It is regrettable that any inquiry should have become necessary in order to remove "misconceptions," as they are called, regarding the use of British Empire products at the British Empire Exhibition. It ought to have been possible to ensure complete harmony and co-operation between all parts of the Empire. As differences exist, however, we can do little more than hope that Sir Wm. Joynson Hicks, Parliamentary Secretary to the Department of Overseas Trade, who has been appointed to investigate the circumstances, will be able to report to the Government and to Parliament with a minimum of delay. Everybody who is studying the world trade situation must see that we and our kith and kin overseas should come closer and closer together in the development of a definite inter-imperial trade policy. The resources of the British Empire are so vast and the needs of the Mother Country so clamant that a concentration of thought and activity in this direction is imperatively necessary. All the schemes advanced for giving employment cannot provide work for a million and a half of our people: general trade recovery must be the chief permanent contributing factor; and we must make many special arrangements for the years that lie ahead if we are to bring trade and industry back to the prosperity that means work for all. Our relations with the Dominions are therefore a matter of vital concern, and the cordial co-operation of all in the British Empire Exhibition of 1924 is absolutely necessary. Nothing ought to be permitted to stand in the way of complete success.

The Electrical Section of the Exhibition.

It must not be imagined for one moment that the investigation above referred to renders it any less necessary for electrical and engineering firms to send in their applications for space promptly. It is most important that intending exhibitors should file their applications before the end of the present month, as the Executive Committee should know by that time whether or not adequate space has been provided to meet the needs of all the manifold groups. The Machinery Hall and the Industrial Hall together covering a total floor area of 884,000 square feet (five times greater than the exhibiting space at Olympia), are two of the largest buildings, and already there is talk of one of them having to be extended beyond the area at present planned. As our readers are aware, the B.E.A.M.A. and the British Engineers' Association have made themselves responsible for the organisation of all machinery, engineering and electrical exhibits. Other industries will be provided for by their own special organisations, and many technical committees are at work. We have already given (Elec. Rev., August 11th, p. 193, and November 17th, p. 759) particulars relating to the electrical side of the exhibition, and we would now urge electrical firms, who so far have hesitated, or have deferred action, to come to an immediate decision, and let their requirements be known. We are in for a big electrical exhibition. Let everybody who counts be in it. Let us make it complete and impressive so that no doubt shall ever have place in the minds of visitors that the British electrical and allied engineering industry and its capacity and resources are great like those of the Empire itself. We close this comment with a renewed appeal for urgent attention and immediate action.

Guaranteed Loans for Electrical Undertakings.

The twelve-months' period during which the Treasury could guarantee loans under the Trade Facilities Act expired on November 10th. The limit placed on the guarantees by the Act was £25,000,000. The actual amounts guaranteed amount to about 23 million pounds. The electricity supply industry has come in for a certain share of this windfall. English electricity supply companies have secured £1,470,100, and the Calcutta Company £500,000. Of the English companies, the biggest allocation is given to the Shropshire Power Co. in the shape of a loan of £700,000 for 30 years, the loan to be devoted to the erection of the new generating station on the Severn at Stourport. This is the 105,000-kW station included in the technical scheme for the South-West Midlands Electricity District. The next biggest loan is to the London Electric Supply Corporation of £650,000, to assist it in the capital charges incurred in giving a supply to the South-Eastern Railway. This amount, of course, at one time was included in the covering loan (for electrification) to the South-Eastern Railway Co., but when the Electricity Commissioners decided that the Railway Company should not build its own station, the part relating to the generating station was allocated to the company giving the supply.

A satisfactory loan is the one given to the North Somerset Co. of £25,000, which is being used for a much-needed extension of mains through that rural area. The Egham and Staines Co. has a loan of £50,000 for new generating plant and distributing mains; the Oxford Co. has a loan of £25,000, the Kent Power Co. £15,000, and finally the Minehead Co. (one of the infants in the industry) a loan of £4,500. These loans added to the lion's share taken by the railway companies result in the bulk of the loan falling under public utility services.

Last week, in connection with its proposals to relieve unemployment, the Government announced its intention to renew the Trade Facilities Act and to increase the maximum amount of capital in respect of which guarantees of interest may be given to £500,000,000; part of this credit will no doubt be allocated to the electrification of railways, but presumably the electricity supply industry will also receive assistance from it.

The foregoing measures relate to the support of private enterprise; in addition, the Unemployment Grants Committee of the late Government was authorised to assist local authorities' loan schemes up to a total of £30,000,000, of which about £25,000,000 has been allocated, and plans for the utilisation of the remainder are being considered, a large number of additional applications having been received, but we do not know to what extent electricity supply has benefited under this arrangement. Sir M. Barlow (Minister of Labour), in explaining the Government's proposals, stated that the railway companies would undertake their programmes of work, including electrification, without any Government assistance, except in the case of the South-Eastern Railway; he said also that electricity supply schemes involving an outlay of about £10,000,000 were being undertaken.

In connection with all these plans for the relief of unemployment, there is one point which, though of the utmost importance, may nevertheless be overlooked until the time for action has passed—namely, that the object in view is to employ *British* workmen. It is essential, therefore, that the condition should be attached to every Government guarantee that all material employed in carrying out the works shall be of British manufacture, and all labour of British nationality. It may seem absurd thus to lay stress on the obvious, but we are certain that the precaution here outlined is indispensable to the fulfilment of the purpose aimed at. We see how, at this very time, the management of the British Empire Exhibition has been arraigned at the bar of public opinion on the charge of having failed to safeguard the all-British and only-British character of that Exhibition; let us make it very certain that there shall be no basis for a similar accusation in respect of the application of British State-guaranteed loans.

Unemployment Insurance and the Electric Supply Industry.

The much-discussed question of replacing the present unemployed insurance by some system of insurance by industry seems now likely to be fully thrashed out. Some little time ago the Ministry of Labour tried to get the views of industries on this question, but nothing concrete resulted. There is, of course, at present a way of doing this to an extent by contracting out. The new Government, however, is apparently taking the matter up in earnest, and Sir Montague Barlow, the Minister of Labour, has sent a Memorandum on the subject to both employers and employed, namely, the National Confederation of Employers' Organisations and the Trade Union Congress General Council. It is explained that the Ministry has quite an open mind on the subject, and is solely inviting suggestions. It is obvious that the proposal would bear very differently on different industries. So far as the electricity supply industry is concerned, it would probably have as small a margin of unemployment almost as any industry. The ordinary staff is, of course, a permanent one. The intermittent labour is practically confined to the distribution side, and even here it is modified by the fact that a good deal of mains laying is done by contract.

Exact figures are not forthcoming, but for purposes of comparison with other trades one might take the figures given in the *Labour Gazette*. The figures given for the public utility undertakings for unemployment come to about 7 per cent., which it will be seen is very low when compared with shipbuilding, which often runs over 30 per cent., and the engineering and iron trades, which run well over 20. Further, this 7 per cent. is probably much higher than if the electricity supply industry were taken singly and especially if it were organised with a view to specifically equalising labour so as to reduce unemployment to a minimum. A revised insurance of this kind would probably necessitate some new representative body to deal with it. The only bodies which at present might do it would be the National and District Councils, but here the organisation on the trade union side is hardly adapted to the special requirements.

Industrial Relations.

Since the new Parliament has been in session we think we have detected a change in the discussions respecting industrial relations. It has become perfectly clear that we are up against a situation which calls for more action and less talk. We suggested a week or two ago that the men representing industry at Westminster should put heads and hearts together to settle the industrial problem. Schemes are developing for making employment; and industrial insurance matters have taken a definite turn so that we may soon see whether it is practicable for the industries of the nation to share their individual burden without restricting progress and hampering us in international competition; but the hard fact of unemployment has taught one thing very definitely, namely, that discussions and conferences of the usual order will not bring work to hungry households. The Prime Minister has been asked whether he will call a joint conference of employers and employed with a view to arriving at an agreed basis for the establishment of a permanent industrial Parliament. In our view such a conference or such a Parliament would be of little immediate use, and we agree with Mr. Bonar Law when he says that the Industrial Councils have demonstrated their value, and that any such action as was indicated by the question could only succeed if it were undertaken on the joint initiative of employers and workmen. Surely more than ever before we have these two classes now represented at St. Stephens's!

Among the signs of the course of the wind is a communication just to hand from the Industrial League and Council. As our readers know, we have again and again urged this organisation and the Alliance of Employers and Employed to join forces. For reasons of their own they have not done so, but we are pleased to note that in the present atmosphere definite steps in that direction are now being taken. A joint committee, consisting of four representatives of each body, has discussed the question of amalgamation and its recommendations are that amalgamation is desirable, that a provisional Executive Committee of 48 (50 per cent. employer and 50 per cent. employed representatives) be appointed to prepare a draft constitution, that all officials shall retire and new ones be appointed by the new body, and that amalgamation shall take place on January 1st, 1923, or as soon thereafter as possible. These recommendations were to be discussed at the annual meeting of the Industrial League and Council on Wednesday, but as we go to press with these pages before the result can be known we must be content now to hope that the right thing will be done and an amalgamated body, the "Industrial Alliance," will emerge, which will enjoy the confidence, and be free from the suspicion, with which the separate parts have been regarded.

What we ought all to be doing just now is to contribute each his little bit towards promoting useful work and trade. If we do that instead of haggling about pet theories and ideals that cannot possibly be realised at present, we shall add to the spirit of confidence which seems to be returning. If we are going to wait for the European situation to improve in order to revive our industries we shall need to pray to be forgiven. Let every British engineer and purchaser think many times before he allows his orders for manufactured articles to go past the British manufacturer. That will be an immediate contribution to the improvement of industrial relations.

D

HYDRO-ELECTRIC DEVELOPMENT IN TASMANIA.

A Comprehensive Scheme for the Generation of 350,000 Horse-power from Water-power, of which the Initial 58,000 Horse-power has been brought into Service.

By FRED. A. TALBOT.

In the popular sense Tasmania has always been regarded as being pre-eminent in the mining, fruit-growing, and lumbering industries, while, owing to its temperate climate and magnificent scenery, it is generally regarded as one of the beauty spots of the world, being extensively favoured by tourists from the Island Continent. Its position, due south of Victoria, whence it is but a few hours distant, renders it readily accessible.

Since 1916, however, the island state of the Australian Commonwealth has commanded greater attention as a manufacturing centre, and this is directly attributable to the remarkable enterprise which has been displayed by the Government in the exploitation of the island's immense hydraulic resources for the generation of electrical energy, the full extent of which has not yet been conclusively ascertained. Although this

Fig. 1.—The Great Lake.

activity is relatively of recent date, Tasmania has already achieved the distinction of possessing the largest hydro-electric installation in the Southern hemisphere.

The topographical conditions of the island, which has an area of only 26,215 square miles—less than one-fourth that of England—are conspicuously favourable, the country being very mountainous. This advantageous feature is magnificently seconded by the meteorological conditions, the rainfall averaging from 29 to 120 inches per annum. This precipitation is well distributed throughout the year, thus simplifying the conservation problem to a very pronounced degree.

From the hydro-electric engineer's point of view, few countries possess such attractive features, the extremely broken character of the island being favourable for the economical construction of dams for the formation of storage lakes and lagoons. The physical conditions are somewhat reminiscent of those of Norway, the tableland or catchment area being situate at an altitude ranging from 2,000 to 4,000 ft. above sea level, thus assuring adequate static head. Indeed, generally considered, the conditions are almost ideal for the development of hydro-electric energy upon an extensive scale at an attractively low cost.

In the first instance, the exploitation of this remarkable power reserve was essayed by private enterprise, work being commenced upon what is known as the Great Lake Scheme some years ago. With the universal awakening to the possibilities of hydro-electricity, the Tasmanian Government, in the knowledge that the industrial prosperity of the country was essentially dependent upon cheap power, acquired control of the undertaking in 1914 to develop it as a national enterprise.

The catchment area of the Great Lake project is approximately 300 square miles, while the elevation ranges from 3,050 to 4,000 ft. above the sea. The annual rainfall on this plateau averages from 30 to 60 in., and the whole basin drains into the Great Lake by natural watercourses and by two channels from adjacent watersheds. Thus the Great Lake acts as the head reservoir providing the necessary storage to equalise the run-off from the catchment. This storage has a capacity of 50,000,000,000 cu. ft., 312,500,000,000 gallons, or 1,150,000 acre-feet.

This storage is one of the largest in the world, as may be realised by comparison with other large reservoirs:—

La Loutre, Quebec ...	3,662,000	acre-feet capacity.
Elephant Butte, U.S.A.	2,600,000	,, ,,
Assouan, Egypt ...	1,865,000	,, ,,
Roosevelt, U.S.A. ...	1,279,362	,, ,,
Great Lake, Tasmania	1,150,000	,, ,,
Burrinjuck, N.S.W. ...	771,641	,, ,,

When it was first decided to exploit this storage facility, a dam of the gravity type was thrown across the outlet, but this has been superseded by a reinforced concrete barrage of the multiple arch type, with the sill 3,333 ft. above sea-level. The theoretical potential horse-power thus forthcoming is nearly 250,000, but it is probable that only one-half of this total will ever be commercially utilised. The initial contribution, known as the Waddamana Power Scheme, which has been completed, and is now in operation, utilises 1,190 ft. of the available fall, the energy generated at the turbine shaft at the power-house continuously being 58,000 b.h.p. A portion of the balance of the commercially-contemplated aggregate is now being investigated, the proposal being to carry development up to 127,000 h.p.

From the Great Lake the water flows down the River Shannon for about five miles, when it is diverted by a low weir into a canal. This conduit, 3½ miles in length, has a bottom width varying from 33 to 60 ft., while the

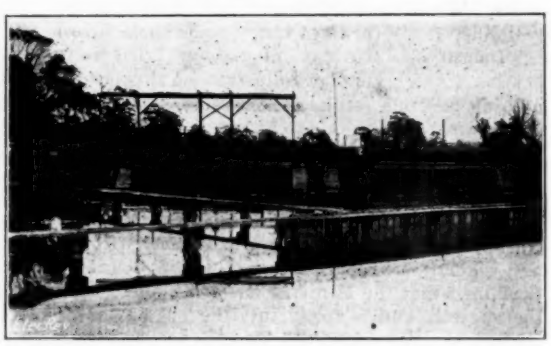


Fig. 2.—The Penstock Chambers.

maximum depth of excavation is about 16 ft. The water depth ranges from 3.5 to 4.5 ft., and as the grade of the canal is less than the natural fall of the country, differences in level are overcome by drops or falls in the bed of the canal.

The canal discharges into a large depression measuring about a mile in length by about half-a-mile wide, covering 360 acres, known as the Lagoon. Confinement of the water in this basin is assured by three long earthen embankments, pitched with rock on the water face, sealing the natural vents. The top of these banks is at an elevation of 3,009 ft. above sea-level, while the

banks have a total linear measurement of 3,500 ft. The difference in level, sill to sill, of Great Lake and the Lagoon is thus about 328 ft., which is overcome by natural waterway and canal in 8½ miles. The Lagoon is thus an extensive lake, the depth of water in which is about 6 ft. maximum, with an average varying between 3 and 4 ft. It constitutes an important feature of the scheme, acting as it does in the capacity of a subsidiary or balancing reservoir, capable of meeting large fluctuations in the load with a constant discharge down the canal from the Great Lake, while, if the occasion arises, it also permits the canal to be shut down for a short period to permit inspection, repair, or any other work which may become necessary.

At the lower end of the Lagoon are the penstock chambers regulating the flow of the water through the pipe lines to the power-house. The penstock chambers (fig. 2) are duplicate reinforced concrete box structures with coarse and fine screens, sluice gates, and valves. The pipe line is an interesting feature of the hydraulic installation for the reason that for the most part it is of wood construction. The original line was 48 in. in diameter, but at a later date three additional lines, each of 60 in. diameter, were laid down (fig. 3). The lines, erected by the Australian Wood Pipe Co., are constructed from wood staves, approximately 6 in. in width, planed to the shape of a segment of a circle, and held together to the designed section of the pipe in the usual manner by circular steel bands and a shoe for cinching.

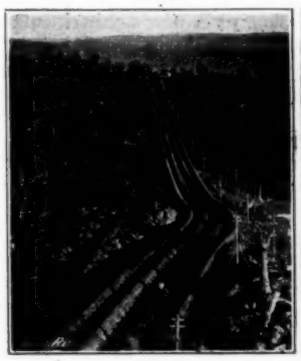


Fig. 3.—Wood Pipe Lines.

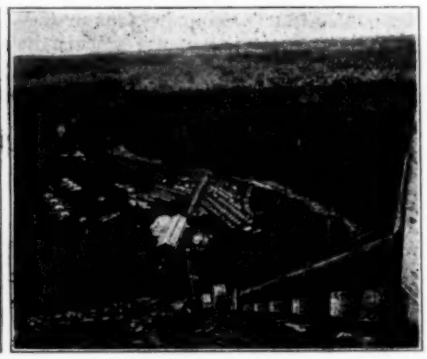


Fig. 4.—Steel Pipes and Power House.

By recourse to wood, pipe-line construction was rendered simple and inexpensive, while the material has proved highly effective in service; repair and maintenance are also easy. Actual construction was carried out expeditiously owing to the simplicity of the foundations. These comprise merely logs cut in the adjacent bush, adzed to the shape of the pipe, and laid upon the surface of the ground, with stone packing to preserve the grade. There was no elaborate excavation to maintain the grade, while construction round curves was also found to be a simple operation.

Each of these wood-stave pipes is a mile in length, and carries the water down to 150 ft. head. The 48-in. wood pipe then branches into two welded steel pipes, while the 60-in. stave pipes are reduced in diameter. Two are reduced to 54 in., which diameter is continued for 630 ft., where junction is effected with 54-in. steel riveted pipes, each 1,670 ft. in length. The third wood pipe is reduced in diameter from 60 to 49 in., and the latter diameter is continued for a distance of 2,300 ft., carrying the water down to 400 ft. head. This is probably the largest wood-stave pipe in the world, with water pressure at 400 ft. head, and was built during the war for the simple reason that steel plates could not be obtained.

The balance of the pipe lines leading the water to the turbines comprises two 950/850/750 mm., and two 50/46-in. welded steel pipes, one 50-in. and two 36-in. lock-bar pipes, respectively. These all connect with a common distribution pipe, 36 in. in diameter, outside the power station. Through valve sectionalisation, any one pipe can be shut off. The static pressure in the pipe is due to 1,120-ft. head, the steel of the 46-in. pipes just outside the station being 15/16 in. thick. All the steel pipes are supported on concrete and masonry piers; all bends are encased in massive concrete anchors to overcome thrust due to change of direction, while expansion joints are spaced not more than 100 ft. apart.

The distribution pipe has nine branches, each feeding a Pelton water wheel. The wheels run at 375 r.p.m. The water leaves the nozzle to strike the buckets at a velocity of 250 ft. per second—170 miles an hour—and after impinging upon the buckets drops into the pit to flow through the tail race, discharging into the River Ouse.

The power-house is at Waddamana, where a convenient site in a dip and beside the River Ouse was staked out for the building and the village which has sprung up, the housing accommodation for the staff and others being laid out on garden city lines. The power station, 272 ft. in length, carries seven 8,000-h.p. and two 4,900-h.p. Pelton wheels directly connected to horizontal alternators (fig. 5). There are also two exciter sets, each of 180 h.p., and two 440-h.p. motor-generator sets. The turbines are governed by oil-pressure governors driven by belts off the main shaft. Current is generated at 6,600 volts, 3-phase, 50 cycles. The alternators are air-cooled and enclosed, inlet and outlet air conduits being provided in the foundations.

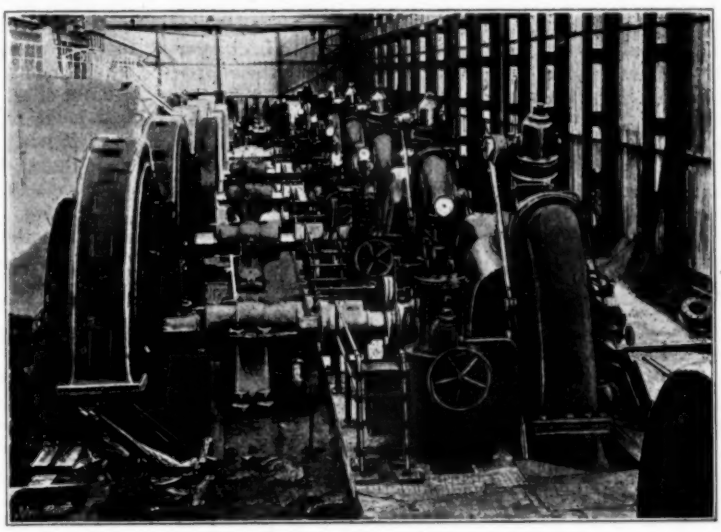


Fig. 5.—Interior of Power House.

A double bus-bar system is adopted, which, with 22 of the latest type, remote controlled 6,600-volt oil switches, reactances, &c., is situate in the switch gallery along the east side of the turbine room and under the same roof. Reactances are in the basement, bus-bars on the ground floor, and switches on the gallery floor, which is open to the turbine room. The control bench-

board is at the south end of the switch gallery and approximately in the centre of the station. From this point the whole generator and transformer station is controlled. Between the control benchboard and the operating valves of each turbine electric signalling is installed, while the electric control of the governors is placed on the benchboard. Opposite the last-named is a vertical switchboard controlling the battery, d.c. power, and all lighting. On this board is also mounted the temperature-indicating equipment for the generators and transformers. At right angles to this board is a four-panel vertical board controlling the a.c. auxiliary and the light and power supply for the village.

The battery and motor-generator sets are situate on the turbine floor level. The station auxiliaries are supplied from 6,600/415 and 240-volt transformers. There is a 300-ampere-hour (10-hour rate) battery supplying direct current for the operating mechanism of the oil switches and for emergency lighting. On this same level and under the one roof is the station workshop.

The transformer equipment comprises seven banks of 7,000-kVA step-up transformers of the outdoor type, transforming from 6,600 to 88,000 volts for supply into the main transmission system. The supply to the line is through disconnecting link switches to the 88,000-volt bus-bars, the take-off by the transmission line being through oil circuit breakers and disconnecting switches. Electrolytic lightning arresters protect the station at this bus.

The transmission system extends from Waddamana to the step-down transformer station about three miles from the centre of Hobart, the distance being 63 miles, and the power is transmitted at a pressure of 88,000 volts over four circuits carried on two steel tower lines. Two circuits are each of 10,000 h.p. capacity, while the other two are each of 20,000 h.p. The 10,000-h.p. circuits consist of three 7/.097 (.05 sq. in.) stranded bare copper conductors attached to the tower cross-arms by string disk-type insulators. Those for suspension comprise four or five disks, while the strain insulators are of five and six disks, the number varying according to the type of disk insulator used. The second two circuits are of similar construction, but are 19/.083 conductors.

(To be concluded.)

SALESMANSHIP IN ENGINEERING.

(Communicated.)

Modern salesmanship is a science and an art. In its application to engineering this appears with much persistency, and only a salesman thoroughly conversant with the laws and principles of selling can hope to achieve success.

In selling engineering products the salesman has many things to contend with; the chief are keen competition, a lack of technical knowledge on the part of some buyers, reputation on the one hand and pure conservatism on the other. Many buyers rely upon the reputation and standing of a manufacturer as a guide to their purchasing—a sound policy, no doubt, but not always an economical one. Keen competition has forced more modern manufacturers to produce articles that can and do compete with the productions of firms with bigger reputations, and experience has proved that their productions are as efficient and reliable, and sometimes more so. However, this does not lighten the task of the salesman selling for little-known manufacturers. For that reason in particular the representative of such a manufacturer must be well versed in the art of salesmanship if he is to overcome the prejudices of a buyer.

There are two branches of selling—the selling of staples and the selling of luxuries. Staples comprise foodstuffs and the like and come under the heading of necessities. Very often they are extensively advertised, a fact which often determines the policy of the buyer; consequently the disposal of such articles does not call for much studied effort on the part of the salesman. Luxuries, however, call for different treatment. The term "luxury" should be taken broadly, for under that head are classed all manufactures not generally recognised as every-day necessities. Yet a luxury may be also a necessity. To many motor-cars are luxuries, but the doctor and the business man, finding their cars indispensable, will say without hesitation that they are necessities. Most engineering articles, while not actual necessities, are indirectly of vital necessity in modern life. This is best understood when one realises that all commercial and artistic progress is due entirely to the unceasing labours of the world's engineers, and all commercial developments are based on engineering enterprise. There is no trade or profession that does not owe something to the engineer, and, similarly, there is no new industry that does not call for engineering help. In short, engineering, in some form or another, is at the back of every commercial enterprise. From such a statement one could be justly excused for thinking that the engineering salesman has a unique field for his operations. He has; but that field is by no means an easy one. Most engineering salesmen are concerned with new *developments*, and a conservative world is very slow to adopt them. When Stephenson invented the steam engine he was laughed at, but to-day, as a result of the perseverance and energy of the engineers who followed him, there are huge steam locomotives hauling trains of over 1,500 tons.

The engineering salesman is faced with a big problem, and it is therefore worth considering the qualities that he must possess. Broadly, he must be a competent engineer as well as a capable salesman, for not only must he be able to sell his articles, but he must be able to expound them and demonstrate their suitability to requirements.

First of all, then, the salesman must have an intimate knowledge of the article he wishes to sell, the process by which it is manufactured, or, alternatively, its construction and its selling points. He will also find it advantageous to be familiar with the selling points of competitive articles. He must have confidence in his goods, in the business he represents, and in himself. He must possess unbounded energy, enthusiasm and optimism, courage, tact, and perseverance. He must also possess the sense of perception and judgment. In appearance he must be neat and well-dressed. Vulgarity in dress creates a bad impression, and the first impression is all important. It is invariably fatal for the salesman to present himself in any but a favourable manner. Then he must be able to talk convincingly on specialised subjects, as well as pleasingly on matters in general. These are the essential qualities of a good salesman.

Broadly speaking, there are three types of people the salesman will encounter—the stolid, the nervous, and the self-confident. The first is recognisable by a certain deliberateness in appearance and manner. He talks little, and it is not easy to gather what impressions are being made upon him. Full details should be given him, as he is not usually capable of forming intensive mind pictures of the article under discussion. The second, the nervous man, is the antithesis of the first. Usually of slight physique, of uncertain and abrupt manner, he invariably forms his own conclusions before the salesman has given much information. The condensing of facts is necessary with this type, a mere outline of the article being all he requires. Intuitively,

he will visualise the details. First interest him. The third, the self-confident man, comes between the stolid and the nervous. It is difficult to describe him accurately, as his type varies so much between the wide limits of the stolid and the nervous. It is generally safe to be prepared for this type, if it is not obvious from the first that he belongs to one of the extremes, by treating him to facts and by getting to business at the start. From his subsequent conversation it will generally be possible to learn what course to pursue—whether to expand or condense one's information. Very often the self-confident man is inclined to be cynical. The salesman should not overlook this fact, but he must not be influenced by it, and he should remember that straight talking and a clear presentation of facts appeal more to this type than any tricks of salesmanship.

The next important thing the salesman must understand is the manner of approach. Experience counts for much in this, as no two cases call for the same treatment and no two human natures respond alike to the same suggestions. In all cases it is necessary that interest be created at the start, for interest is vital to the satisfactory conclusion of any sale. When an inquiry comes direct from a prospective buyer, interest has been created by advertisement or some other means. Where no inquiry is received the salesman must create the interest. For example, I have in mind the case of an indifferent salesman who, some years ago now, called upon a much-harassed business man with the object of selling him a typewriter, but so befogged him with illustrations, pamphlets, and a lengthy explanation that the sale was never concluded. Later, an enthusiastic and enterprising salesman called on the same business man for the same purpose. While engaging his attention, the salesman set up a typewriter and then asked the prospective buyer to dictate any matter he wished. He complied, and watched with interest the salesman type out the message as it was given. Handing the neat typewritten sheet to the gentleman, the salesman said, "That's what it can do, and the speed at which it can do it." The sale was effected. This is an example of correct approach, the creation of interest and thorough familiarity with the article offered.

It is not always practicable, however, to place the article before the prospective customer. The salesman cannot set up an engine in the other man's office, neither can he expect him to go and see an engine working at some other place. He must find other means, by the power of suggestion, of creating interest, and this is often done by arousing curiosity in prospective buyers' minds and a feeling of something to be desired. The salesman's opening remark should, therefore, be one likely to command the person's quick attention. As an illustration: A salesman travelling in the South of England came across a flour mill driven by an old wooden water-wheel. Sensing the possibility for the sale of an oil engine, he proceeded up stream and measured the flow of water, calculating therefrom the probable horse-power developed by the wheel. He also made a few inquiries as to the amount of business done by the miller. Finally, obtaining an interview with the miller, he said, "I would like to put you in the way of doubling your turnover and more than doubling your profit." And he compared the work obtained from the water-wheel with the work the miller could do with an oil engine and a slight increase in plant. The miller was interested, and subsequently made the conversion.

But the salesman cannot always expect success from these methods. Sometimes his man will not be interested. A conservatively-minded person is the most difficult to interest, but even here continued perseverance and tact will often meet with success. Here is an actual instance: The sales manager of a large electrical undertaking had tried repeatedly to interest the very conservatively-minded owner of a steam-driven engineering works in the advantages of electric power, but without success. Time after time he called, but always received the same answer: the engine had served the owner's father and would serve him, and no argument would convince him to the contrary. One day when the salesman called he found the works shut down. The steam plant had given out. Without waiting to be invited, he examined the engine, located the trouble, rectified it, and got the engine running again, much to the astonishment of the owner. A few days later he received an invitation to call, and then learnt that he had so impressed the owner by the kindness of his assistance when he might have used the occasion as an argument in favour of electric power that the owner intended to install electric motors right away.

Much more might be said on the methods and details of a salesman's equipment and campaign, but such things are largely matters of experience and occasion.

However, the principle is this—and the buyer must realise this fact: The modern salesman is not a tout, but a thoroughly capable and live member of the business community, seeking, by his efforts and specialised knowledge, to introduce the most efficient article to the buyer, to the benefit of buyer and seller alike. That salesmanship is being recognised as a specialised art is proved by the increasing number of firms which have instituted their own organisations for the training of their salesmen.

THE APPLICATION OF ELECTRICITY TO AGRICULTURE.

By R. BORLASE MATTHEWS, M.I.E.E.

In connection with the Engineering Exhibition that was recently held at Cardiff under the auspices of the South Wales Institute of Engineers, a conference was held at the Institute, at which several papers were read and discussed, amongst them being one on the above subject, in the course of which the author said, *inter alia*:—

Undoubtedly one of the main factors essential in economical farming is the reduction of the power cost (be it of man, horse, or other agent) to the lowest possible figure. It is not generally realised that the total amount of power employed on the farms, even of this country, far outweighs in the aggregate that required in any other industry. Nearly 200 British farms are now making some use of electricity, and their practice is supported by many thousands of farms on the Continent, in the Colonies, and America. In point of fact the encouragement of the use of electricity is one of the avowed objects of the agricultural policy of several countries. The British farmer is in a very sad plight, hence it is necessary for the engineer to come to his assistance, and this he can only do by a careful study of the farmer's requirements.

On the list of the present applications of electricity to farming the items already reach the respectable total of 165, and doubtless there are a considerable number more. Even at the very high rate of 10d. per kWh the cost of producing a given effort on a farm is cheapest by electrical means; tractor effort costs 2.3 times, horse effort from 5 to 6 times, and man-power at least 17 times as much to perform a given task. By these facts it is not intended to demonstrate that the horse should be entirely superseded on a farm, as there is often some special work that is not easily carried out by machinery. However, on the electrically-equipped farm one horse should suffice for a small holding, and two for those of 300 acres or over.

Steam-generated electric power is sold more cheaply at Newcastle than hydraulically-generated power at Niagara. Owing to the high cost of water-power development the annual interest is often higher than that of a steam station, plus the cost of the coal it consumes. It is much preferable to obtain power from a public supply, but the average farmer can very profitably generate his own electric power.

Cost of Equipping a Farm.—On the basis of credit for selling some of the unsuitable existing plant the average mixed 300-acre farm could be electrically equipped for about £600 and a 600-acre farm for about £1,100. A small farm of under 150 acres without an electric plough would require about £1

capital per acre. To modernise an existing equipment is always very different from starting out with an entirely new installation. The net result of expending this new capital would mean an increased annual profit of about £300 per annum on a 300-acre farm; on a farm of under 150 acres a return of about three-fourths of the capital invested per annum, and on a 600-acre farm a return of about £650. If weather were to adversely affect neighbouring farmers these profits might easily increase by 50 per cent., due to hay making, corn-sheaf drying, ploughing, &c., being carried on by electrical means regardless of weather conditions, *i.e.*, what would otherwise be losses are turned into gains. The above figures indicate an enormous return on the extra capital expended, and in a bad year would make all the difference to the balance sheet of the farm. Most farms are so badly engineered that in many cases a new farm could be electrically equipped by an experienced engineer at very little more than the cost of the existing equipments on other farms; and certainly there would be a great reduction in the running and labour costs of the electrically-equipped farm.

Energy Consumption.—Continental experience shows that the annual consumption of electricity in farm buildings alone is proportional to the size of the whole farm, and averages 10 kWh per acre. The consumption in the farm-house would average 7 kWh per 33-watt lamp per annum, or an average of 210 kWh. To this must be added 800 kWh for heating, cooking, and domestic power. If the farm were very modern there would be, in addition, a consumption of 33 kWh per acre of arable land for ploughing, plus one-third of this for cultivation, electro-culture, electric silage, harvesting, &c., or a total of 44 kWh per acre.

TABLE I.—ENERGY CONSUMPTION.

Area of farm acres.	Usual farm buildings, max. demand, h.p.	Farm buildings, kWh per ann.	Farm land, kWh per ann.
1	–	10	44
150	3	1,500	6,600
300	5	3,000	13,200
600	15	6,000	26,400

Load Factor.—On an intelligently equipped farm a load factor of 33 per cent. may be anticipated. Table II. gives some idea of the approximate load factors of some electrically equipped farms.*

TABLE II.—LOAD FACTORS.

Type of farm	Farm only, per cent.	With addition of farmhouse lighting, cooking, and part heating, per cent.
Dairy	13	24
Mixed	15	25
Arable	31	33
Poultry	40	45

Since the size of farms varies considerably, it is useless to assume that, if a 600-acre farm has a demand of 25 kW, the generating station demand will be 25 kW per square mile. In any event, the supply undertaking would run its lines along the route of the maximum demand, and Continental experience shows this practice to be advantageous in units of 50 kW. Further, farms cannot be considered apart from rural industries and the varied demands of even small villages in the same neighbourhood.

Distribution.—This is not so troublesome as might at first be anticipated, since each stationary ploughing gear has to be brought into only one corner of the field it has to plough, it is merely necessary to bring the distribution lines within reach of the plough flexible electric cable, which is usually over 100 yards in length. Permanent lines are justifiable if other operations than ploughing are undertaken. However, on the Continent, to economise in copper, posts and insulators are installed permanently and the copper lines are moved about as required. The author has one transmission line crossing his farm, and has planned one other line at right angles to it. He hopes that this simple arrangement will be sufficient for all the farm field requirements. The author employs a bare-wire overhead ring main encircling the farm buildings, and taps off this at convenient points, with insulated conductors attached to the line by a special fitting of his own design.

On the Continent it has proved most useful and economical to employ electricity on small holdings of a few acres. Electricity costs so very much less than human labour that it is most important to let it do all that it conveniently can. The capital investment is low, for the power required rarely exceds two or three horse-power. As regards the use of electric power in the farm buildings, the methods employed are more or less on conventional lines. The author's experience is that direct drives* (with either fixed or portable motors) are most suitable.

Table III is illustrative of typical farm electric drives and the economies that are effected thereby:—

TABLE III.—ELECTRIC DRIVES.

Machine.	Work done per hour.	Speed of machine pulley.	Size of motor.	Work done per kWh. consumed.
		R.P.M.	H.P.	
Cake-breaker ...	13 cwt.	140	1	1¼ tons
Chaffing	3 tons	300	10	0·5 ton
Churn (with butter worker)	170 lb.	30	2	165 lb.
Clipper (horse) ...	1-2 horses	1,300	½	3-4 horses
Cream separator ...	135 gallons	650 (bowl 6,000)	1½	260 gallons
Ensilage cutter (rye)	5·5 tons	300	10	0·66 ton
Feed grinder ...	40 bushels	1,800	25	3·3 bushels
Groomer	6-7 horses	1,300	1	9 horses
Harvester and binder	2 acres	360	*1½	1·5 acres
Milking	90 cows	42 pulsations, central pump 390 r.p.m.	3	52 cows
Oat crusher	50 bushels	500	2	22 bushels
Root cutters ...	6 tons	150	2	6 tons
Thresher	150 bushels	1,200	15	7·7 bushels

Ploughing.—Extensive practical work in Germany, Sweden, Italy, and France has shown conclusively that electric ploughing offers all-round advantages over any other method. Much progress has recently been made in the construction of electric ploughing sets. For work on the average farm the single rope, double-drum method (similar to the Howard steam round-about system), appears to be the most suitable.

The electric system differs from its steam predecessor in that the haulage gear is very much lighter and the anchorages are much improved, and have not to withstand such great strains. The system is well adapted to small fields, as the haulage set only enters one corner of the field. (Very large fields would be ploughed in several sections.) Once set up in a field two comparatively unskilled men only are required. The effort required to plough is practically directly proportional to the total area of the furrow slices being cut at a time. Two speeds are usually provided, namely, 3 ft. per second (2 m.p.h.), and 5 ft. per second (3.6 m.p.h.). While the maximum furrow length with horse ploughing is about 250 yards (and from 15 to 20 per cent. of the day is spent in turning, exclusive of resting), the electric plough will travel any distance desired, the limit being set only by the difficulty in signalling, which is experienced where the furrow exceeds a quarter of a mile in length. Turning time is only from 15 to 30 seconds per furrow, and no resting periods are required. Table IV. gives actual results obtained with electric ploughing equipment:—

TABLE IV.—ELECTRIC PLOUGHING.†

(Average land in good heart.)

Depth of furrow, in.	Acres ploughed per hour.	Consumption, kWh per acre.
6	2.5-3	14
8-8.75	1.8-2	17
10	1.8	18
12-12.75	1-1.25	24‡
12-14	1-1.25	33
10, plus 6 subsoiling.	1.25-1.4	36-40

TABLE V.—COST OF PLOUGHING.

(Assuming a net effort corresponding to 15 h.p.-hours per acre.)

Methods of haulage.	Cost per unit, pence.	Cost per acre for equal conditions.
Horses	48	£2 0 0
Oil-tractor	23	£1 0 0
Electric	5	£0 6 8

In the above comparison no allowance has been made for interest, depreciation, repairs, &c., for the plough or for the ploughman's wages; management and overhead expenses are not included. With the improvements which will undoubtedly be made in electric ploughing sets the economy of using electricity will eventually be much greater than is indicated in Table V.

Electro-Culture.—By the stimulating effect of the influence of electricity on plants a definite minimum increase in the harvest yield can be obtained. The author is satisfied that an electrically-treated crop may be reckoned upon to produce at least 10 per cent. more grain and a proportionate increase in straw.

Haymaking.—The farmer need not, in future, wait for the weather, for the aid of electricity provides an artificial

* The load factor of wood-working factories is 5 per cent., and that of engineering works 6 per cent. Printing works have a load factor of 8 per cent., while cloth factories have a load factor of from 10 to 25 per cent.

*For knife and binding mechanism.

†Figures for "acres ploughed per hour" depend on the capacity of the ploughing set. The consumption is independent of the actual time taken to plough an acre.

‡This result was obtained when ploughing 3-year lucerne on sun-baked land.

means of producing hay as good as, if not better than, good natural hay, and certainly much better than can be made under normal bad conditions. To obtain properly cured hay as distinguished from merely dried grass (since the latter has no fodder value for animals) temperature control must be employed which allows certain bacteriological and chemical changes to take place. The results obtained in this country should go far to revolutionise haymaking and save the farmer very considerable sums of money.

Table VI.—Haymaking.

	Sun-made. s. d.	Electric fan-made. s. d.
Cutting	10 0	10 0
*Turning (twice) ...	6 0	Nil
*Raking (once) ...	3 0	Nil
Windrowing	3 0	3 0
Carting and stacking	18 0	18 0
Cost of electrical power	Nil	1 3
Interest and depreciation of blowing plant costing £60	Nil	1 0
Total costs per acre	£2 0 0	£1 13 3

Harvesting.—The author has proved that an electric motor driven binder (obtaining its power from a dynamo mounted on the tractor that hauls the whole outfit) will cut one-third more acres of corn per day. Also it cuts the straw closer to the ground—a matter of considerable importance when the straw is short as happened in some parts of the country this year. Actual results in this country show that advantages are actually gained. Immediately after cutting the corn can be stacked and dried, in a similar fashion to that described above for hay.

Electro-Silage.—The method of conserving green fodder in silos for the winter has lately come into extended use. It is claimed that by electrical silage, of which there are already nearly 100 examples in Germany, fodder is better preserved, as objectional bacterial action is arrested before it has time to do any damage. The power required is up to 10 kVA for a silo of about 20 ft. in height and 14 ft. in diameter; the time required is from 24 to 48 hours and ten tons of fodder require between 130 and 200 kWh.

Threshing.—In order to reduce the power and also the number of hands required it is now found advantageous to carry out the work in two stages. In the first machine the corn is threshed and cleaned sufficiently for the farmer's own needs. In the second stage only that portion of the corn (from the thresher) that is intended for market is finally dressed, cleaned and graded. Either machine can be driven by a 5-h.p. electric motor.

Table VI gives particulars of tests carried out on Dutch farms with threshing machinery of the type described above. Similar equipment has been installed at the author's farm.

Table VI.—Cost of Power for Electric Threshing.

(Commercial tests with electrically-equipped machinery).

Crop	Bushels	Time, minutes.	kWh consumed.	Cost of power at 5d. per kWh.
Barley†	50	60	5.98	2s. 6d.
Oats	50	60	5.24	2s. 2d.
Rye‡	52	150	12.3	5s. 2d.
Wheat	98	140	11.0	4s. 7d.
Stacking straw§	1,100 lb.	11.3	0.72	3½d.

When a trusser is used for binding the straw the power consumption is increased by one-eighth kWh per hour, but three or four workers can be dispensed with. The cost of running the trusser is only 9d. per hour with energy at 5d. per kWh. In contrast with the above power cost of less than 5d. per quarter, a prolonged test on an oil tractor-driven thresher at a farm in Kent recently gave a power cost (inclusive of interest and depreciation, but not including tractor driver's wages or management expenses) of 28d. per quarter on 850 quarters.

Conclusion.—In this paper an attempt has been made to collate, in a brief summary, some of the more important aspects of electro-farming. It has dealt with the practical present, without attempting to look into the future. The solution is most satisfactory to the business-like farmer, for it is far removed from being merely a rich man's hobby, or the idea of an eccentric. After all it is but the application of the principles of other industries to agriculture. The work described has either been carried out on commercial lines at the author's 600-acre farm, or else has come to his personal notice when carrying out trials on other farms or inspecting Continental farms.

Discussion.

There was a large attendance, and many of the Welsh farmers showed a keen interest in the lantern slides and kinematograph pictures illustrating the applications of electricity to farming. Mr. Richard Stratton, a Monmouthshire farmer, opened the discussion by saying that electricity appeared to have an adaptability which few of them realised, and there must be a great future for its use in farming. A young man, before he started farming, should undergo training for a year or two in agriculture, and even in electrical engineering. He understood that electricity had a very important effect on vegetation, and the question arose whether it should not be generally applied by farmers.

With regard to the hay-drying system, he could not help thinking that those who advocated the use of electricity were right.

Mr. W. W. Hood expressed the opinion that they were on the eve of a revolution in agricultural development, through the utilisation of electricity, and he went on to explain the experiments which he had conducted upon farms which he had cultivated. He had found his knowledge as a mining engineer, he said, of real use to him in carrying out his experiments with regard to haymaking under varying climatic conditions.

Mr. Illtyd Thomas, Cardiff, had come to the conclusion that electricity, as applied to farming, was becoming a very practical question. Farmers were as a rule very conservative, and it took a long time to get them to adopt new principles, but he sincerely hoped that the agricultural community would adopt the use of electricity.

The Chairman (Mr. David E. Roberts) commented upon the use of electricity on even small farms and small holdings, and referred to the great development which had been made in Canada through the utilisation of electricity on farms. When there he was very much impressed by the progress made in this direction.

*These operations would be repeated in unfavourable seasons and the cost would consequently be greater. The fan-made hay cost is independent of weather conditions. It must not be forgotten that the present method of cutting and carting can be simplified and changed where field drying is not required. This will reduce the cost of fan-made hay still further.

†Thresher equipped with treble cleansing apparatus.

‡6,300 lb. of straw.

§The straw was unloaded from cart and blown on top of a stack 33 ft. high.

ELECTRICAL POSSIBILITIES IN IRELAND.

Lecture and Discussion at I.E.E. Centre.

An interesting address on the development of electrical industries in Ireland was delivered at Dublin on November 24th by Prof. W. J. Lyons, Head Master of the City Technical Institute, under the auspices of the Institution of Electrical Engineers, Irish Centre. Mr. E. C. Handcock, M.I.E.E., chairman of the Centre, presided.

Prof. Lyons said, *inter alia*, that the time was opportune for the consideration of the important developments which the utilisation of electricity suggested, and went on to urge that in Ireland such developments were likely to be best effected by one general Irish company, sufficiently capitalised by Irish capital, working on satisfactory bases, as required, with other countries. There had been a transfer of important powers to the Free State Government, and in this connection he dealt in some detail with the problems as to limit and scope of manufacturing, assembling, repair work, possibilities in the matter of radio telegraphy, the position of things in relation to patents in the new State, and the respective aspects of capital, labour, and organisation. A recent comprehensive Continental tour had enabled the lecturer to submit valuable analyses for the information of the Centre. It was most desirable, he contended, that they should do all they could to promote and foster electrical industries in their midst and, to that end, to provide gear and equipment.

Alluding to a direct radio telegraphic service, he remarked that France, Belgium, and other countries were watching the technical and commercial aspect of the question, and they should do the same in Ireland, where they should have a direct service established in the Post Office system, for, he added, the importance of a terminal in Ireland appeared to be more clearly realised abroad than it was at home. There was no reason why they should not be able in that country to assemble the various complex and component parts. He thought the question of skilled labour should not be emphasised too much. Until recently, when anything went wrong with electrical gear, they had to send across the Channel to have it made right. That was not as it should be. There were no people more capable than the Irish of acquiring and making the most of technical instruction, or of taking advantage of organisations set up on their behalf and of the necessary capital invested. He did not consider that the Government should have control, and did not favour monopoly, but the Government might be induced in very exceptional cases to favour protective tariffs, and in this way the best terms might be made with other countries.

Discussion.

Mr. G. M. Harriss agreed with the lecturer's proposal, stating that from a small start they could build up large industries. They were all aware of what had been done in

Ireland during the war, when they had to fend for themselves in the matter of repairs and in other respects.

Mr. Porte observed that the Irish were as keen and quick as any other people in picking up details of electrical affairs. He advocated small undertakings, which should be built up on their merits.

Mr. Darrell Figgis said it might be that they would have to pay more for materials at home, but they would, in the long run, find it perhaps cheaper to use home materials than to get those of foreign manufacture.

Prof. Clarke endorsed views expressed as to the value of small undertakings.

Mr. J. J. Simington said he had often felt the disadvantage accruing from the fact that almost every penny spent on electrification works was leaving Dublin and leaving Ireland, and he hoped the lecturer's address would help to stimulate native energy and enterprise.

SALESMANSHIP IN THE ELECTRICAL INDUSTRY.

Mr Wallace Attwood, the expert trainer of salesmen, delivered the second of his series of three lectures on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," under the auspices of the Electrical Development Association, on December 1st. In the absence of Mr. Hugo Hirst, Mr. L. L. Robinson, of Hackney, presided.

Mr. Attwood first dealt with the question of what was meant by the term "value" in selling. He said that in every instance, value lay in the service, satisfaction and pleasure an article gave the buyer, rather than in its intrinsic worth. In general, the value of an article was the degree in which it could supply the needs of the customer or contribute to his personal satisfaction and pleasure. In all cases, the value of an article could be greatly enhanced by the way it was presented and the personal service surrounding it. Sometimes value was expressed as the price the commodity would bring in the open market; in other words, "supply and demand." The difficulty, therefore, was to measure value, and there was no one standard method of doing it. By the aid of charts, the lecturer explained intrinsic value, distribution value, and usage value, passing on to production charges, distribution charges and sale charges, and demonstrated how these all contributed to a true approximation of value and selling price. At the same time, he emphasised the point that there was a big difference between value and price, and repeated what he said in his first lecture that the good salesman would put price on one side and deal in his commodity on the basis of the service the article would render the purchaser.

Comparing the relative values of a large diamond, a bottle of medicine and an electric radiator, he pointed out that the diamond would always retain the value denoted by the price, and the value lay almost entirely in its intrinsic worth. In the case of the bottle of medicine, the intrinsic value was negligible compared with the service. On the other hand, in the case of the radiator, this had an intrinsic worth and an added value by reason of the use to which it could be put. Hence the radiator was justified both by its intrinsic value and by its use or service.

Another point emphasised was that the salesman was the last link in the chain between the manufacturer and the customer, and he repeated the maxim that "Sales always precede profits." In order that the salesman should be as efficient as possible, a general plan was outlined dealing with the analysis of the product; this would be modified, more or less, according to the particular product, and after the analysis had been assimilated by the salesman, it was recommended that he and his firm should undertake an analysis of the range of possible purchasers. It was remarkable, said the lecturer, to find the large number of firms that adopted "hit or miss" methods in assessing the complete field of demand which existed for their products. He believed that it was safe to assert that the full possibilities for any product had never been fully exploited. Even where there was a near approach to this ideal, the gradual march of time, cycles of trade, altered circumstances, and the evolution of the habits of the consuming public, continually presented new opportunities to the sales manager who used correct methods of analysis for enabling him to keep his finger on the pulse of the buying public. An "Analysis of the Market" was then shown in chart form.

The next branch of the lecture dealt with getting more business and indicated the various more or less well-known methods, such as direct approach and impersonal approach, through the medium of publicity, window display, and the post. The lecture gave much good advice to the young man just commencing training as a salesman.

There was not much discussion. One point made by the lecturer both in the first and the present lecture was that the price should not be cut but that sales should be on quality and service. *Apropos* of this, Mr. Riley asked how it was that Mr. Henry Ford was able to cut his price and yet sell. Mr. Attwood replied that Mr. Ford did not cut prices on the road, but had concentrated on production methods and so was able to sell at a very low figure and at the same time pay high wages.

Mr. Gillott asked whether a manufacturer should have a higher percentage of profit when he sold directly than when he sold through a retailer, or if he advertised in such a way that the public were induced to go to the wholesaler or the retailer.

Mr. Attwood said that a manufacturer always allocated a certain proportion to advertising, and the selling price took that into consideration. It followed, therefore, that if the sales were direct to the public and the manufacturer charged the same price as the retailer, then the manufacturer would get a higher rate of profit but the public would pay the same. On the other hand, the fact that the manufacturer advertised largely, enabled the retailer to sell more of the article than he otherwise would do.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Annual Festival Dinner.

On Wednesday last week the Festival Dinner of the Electrical Trades Benevolent Institution was held at the Trocadero Restaurant. The President of the Festival was Sir James Kemnal, the vice-presidents being Mr. J. S. Highfield and Mr. E. S. Barralet, and there were some 120 guests, including Sir George and Lady Sutton, Sir Wm. Noble, Mr. Dane Sinclair, and many other well-known supporters of the Institution.

After the loyal toasts the president said the present was a bad time to appeal for subscriptions, but most of them could give something. The electrical industry had grown enormously since the days when he worked on the first installation of electric lighting on Holborn Viaduct; then there were few electrical men—now there were as many thousands. The subscriptions already received in connection with the Festival amounted to £725 16s. 9d.; the fund, without this addition, stood at £18,780, and they wanted to make it £20,000. The benefits were chiefly extended to those who fell on evil days and were not provided for in other ways; pensions could only be given out of the interest on the main fund, which, therefore, should be much larger.

Mr. Highfield, supporting the appeal, said that they must endeavour to make the Institution a really strong body; its success depended mainly on gaining new contributors—otherwise it would remain merely a "fund." It was conducted in harmony with the Benevolent Fund of the Institution of Electrical Engineers, and there was no overlapping. He heartily supported all that the President had said, and hoped that the funds—and particularly the membership—would continue to grow.

Mr. Barralet also supporting the appeal, made a humorous speech, touching upon many topics, and urged his hearers not to wait till they were old before they were benevolent; now was the time—there was always a proportion that one could spare.

The President then proposed the toast of "The Electrical Trades Benevolent Institution," which was duly honoured. The collection at the tables realised £101 11s. 6d., making, with the sums previously received, a total of £827 8s. 3d.

Mr. J. Y. Fletcher proposed the health of the chairman, thanking him for his help in the threefold capacity of president, donor, and employer of labour—the last being one of the best ways of helping the respectable poor of the electrical industry, who were particularly reluctant to come forward with appeals for assistance. The committee was anxious not to reject any application, and none had been refused during the past year. The fund had now arrived practically at £20,000, but they must not stop at that sum, which was not sufficient to provide for pensions—the primary object of the fund; it should be more like £50,000. There was ample money in the industry to increase the fund by four or five thousand pounds a year.

Sir James Kemnal briefly acknowledged the toast, and endorsing Mr. Fletcher's remarks, said the industry was able to find £50,000, but the fund still fell short of £20,000.

During the evening a programme of music and song was performed by Mr. Barrington Hooper, Mr. Sterndale Bennett, and Mr. Bernard Flanders.

Eagle Causes Failure of Power.—The *Daily Mail*, in a recent note, adds another to the list of birds and beasts who have become entangled in electricity supply systems with adverse results both to the systems and themselves. Grenoble (Isère) was plunged into darkness for several hours on November 21st by the descent of an eagle upon the overhead supply mains, and it was found impossible to restore the supply until the bird's body had been completely burnt.

LEGAL.

H.M. Postmaster-General *v.* William Henry Pearce, Ernest Pearce, and William Robert Moon.

An application in respect of telephone cables was brought before the Railway and Canal Commissioners' Court on November 29th, by the Postmaster-General against the three defendants. The Postmaster-General asked for an order, equivalent to a consent by the landlord, to retain, in Morsland Mansions, Maida Vale, telephone wires which ran through the storerooms of the flats, which the landlord had given the Postmaster-General notice to remove.

Counsel for the Postmaster-General said he made his application under Section 1 of the Telegraph Construction Act, 1916, a section the Court lately considered in the important case of the Postmaster-General *v.* Brooks. Thirteen of 104 tenants had used the telephone; others objected to the visits of workpeople to the wires, which were in all the storerooms. Some of them appeared to store china there and others coal, and the coalmen with their bags dragged the wires adrift. The wires were laid with the consent of the owners, and it was said that one of the Mr. Pearces indicated where he preferred they should go. The Postmaster-General had been before Mr. Lester (the Stipendiary Magistrate), but the magistrate, after the recent judgment, sent him here. Mr. Pearce suggested that the cables should be led down the street, and not through the cellars, and connections taken off at house doors as they were needed; but that would be expensive to the public.

Mr. Dollar, for the defence, explained that the cable passed through 25 storerooms, the majority occupied by non-subscribers, and junction boxes were in some of these storerooms.

Mr. Justice Lush said it was understood that the defendant had the right to give three months' notice to remove the wires. Only a small number of the tenants in his flats had the telephone, and the other tenants complained of the inconvenience of workmen going into their storerooms to repair the wires. The Court was satisfied that there was a serious nuisance created with regard to those particular tenants, who had a perfectly just cause of complaint. Mr. Pearce, in 1913, called on the Postmaster-General to remove the wires, withdrew his request, and on the renewal of complaints again gave notice. The Postmaster-General asked the Court for an order, which amounted to a request, that these wires should be continued through the flats. It seemed to his Lordship that the only possible condition on which such an application could be granted would be that it was shown to be necessary in the public interest, as in the case of the Postmaster-General's desiring to carry his wires over privately-occupied land. It seemed to his Lordship that the Postmaster-General here only desired to utilise the property of those residents because it would be more easy and convenient to him, and that was very far removed from cases in which the public interest was concerned. What it really amounted to was that the Postmaster-General was seeking to carry on this business of laying telephone wires on more advantageous terms than in the ordinary course, and at the expense of the private owner. In his Lordship's opinion the private owner had a right to be protected, and it seemed to him that the continuance of these grievances of the tenant must tend to react against the interest of the owner of the property. On all these grounds the application must be dismissed, with costs.

Electricity Charges Disputed.

On November 29th, at the Chichester County Court, the Bognor Gas Company sued Charles Knowles, Furnishers, Ltd., to recover £2 7s. 7d. for electricity supplied. Mr. Jackson, for plaintiffs, said that the defendants had several separate premises in Bognor, and an agreement for the supply of electricity was entered into in each case. Charges were based on a sliding scale, there being a fixed charge for the first 50 kWh and gradually falling charges for larger quantities. The defendants maintained that they were entitled to be considered as one consumer, to be charged for their electricity as a whole. To this the plaintiffs would not agree, stating that each set of premises would be considered separately, and charges were made accordingly.

His Honour Judge Cann decided in plaintiffs' favour, awarding them costs on Scale B.

Electric Pumping in South Africa.—The barrage on the Vaal River in South Africa—which ranks as one of the world's great engineering schemes of its kind, and was begun in October, 1916—is now to all intents and purposes completed. It will enable Johannesburg to have a large and pure water supply. The river pumping station is practically completed. The plant consists of electrically-driven vertical-spindle centrifugal pumps, the motor itself being installed 9 ft. above the highest known flood level. The pumps are each capable of raising 6,000,000 gallons per day against a head of about 80 ft.—*Daily Mail.*

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Shift Engineers' Salaries.

High and low in the electrical profession look upon the Electrical Review as the foremost journal in all electrical matters, even to seeing justice done to a vital organ of the electricity supply industry—" shift engineers," so please Mr. " P. G. H." cancel out your eye-wash, the poor substitute of sending to the E.P.E.A. journal, even if we could at last get publication.

I can assure the above gentleman that there is an abundant amount of dissatisfaction among the shift engineers upon the schedule and conditions as presented by the E.P.E.A., and they would like the following questions answered, through your columns, by some reliable E.P.E.A. official:—

Had shift engineers representation on the N.E.C. in pre-schedule days?

If any, what proportion?

Why a gross injustice of difference in salaries between the chief and works super in pre-schedule days should be transferred to between Grade 3 and Grade 8 at present? Why the word highest should be affixed to Grade 8 only? Why a lower maximum salary for Grade 8 was decided upon than was being paid in some municipal and company undertakings at the time?

Are they aware that even less hours were being worked by some shift engineers than was fixed by schedule? Why should Grade 8 be taken as a fixed and tied basis? Why was not a fair and just relative difference made all the way through the staff in grading?

Why should large, medium, and small undertakings be governed by a schedule so obviously drawn out to suit the few extra-large undertakings?

Why should *bona-fide* electrical, steam, and mechanically-trained men be expected to jump more grades as the next step in promotion than the purely electrically-trained man?

I feel sure, Mr. Editor, that an answer to the above will undoubtedly tend to educate the shift men in the manner their case was handled by those they at one time trusted.

One Out For Information.

December 3rd, 1922.

Although reluctant to take up any part of your valuable space in further discussion of a subject which by now must be in process of becoming tiresome, perhaps you will allow me to make a few observations.

In the first place, exactly what definite benefit do your correspondents expect to gain by persistently grousing in your long-suffering columns? Were there even a suggestion of constructiveness in any of the letters published to date, some good might conceivably result, but this ingredient has been conspicuously absent and analysis has so far revealed one hundred per cent. of hot air. Possibly the gentlemen who are thus laying bare the travail of their souls have in mind some such adage as: " Constant dropping wears away stones," or its companion: " Little strokes fell great oaks." They will probably find, however, that the " wear " will most affect the patience of the Editors of the Electrical Review, who will themselves eventually deliver, not a " little " but a sufficiently heavy stroke in the shape of: " This correspondence is now closed."

That shift engineers have a legitimate grievance in their grading under the E.P.E.A. Schedule is true enough, but the method whereby some of them are attempting to remedy the situation is predestined to futility. Let them apply pressure in the quarter where it can alone be effective, that is, in the councils of the E.P.E.A. Let them make their voice heard at their general meetings, and, if they wish for greater emphasis, to invoke the aid of the Fourth Estate, in the correspondence columns of the *Electrical Power Engineer*, which are at their service.

The washing of dirty linen is really a domestic matter, and as a shift engineer and a fellow-member of the Association, I would urge those of my colleagues who feel aggrieved to refrain from this ineffective public parade of their disabilities. It can do no possible good; it may, by acting as an irritant and in other respects also, prejudice the very cause they have at heart.

W. H. S.

December 3rd, 1922.

The " Standard " Brush-holder.

The letter from Messrs. Bates and Windibank, published in your issue of November 3rd, 1922, calls for some comment on our part, particularly in view of the further letter from Messrs. Flather & Co., Ltd., published in your last issue.

We are surprised that a firm of Messrs. Bates & Windibank's experience can fail to notice the important differences between Messrs. Flather & Co.'s brush gear and our own. It is true

that the brush gears are similar in the method of fixing the brush spindles in the slots of the rocker and in using packing pieces to compensate for commutator wear, but this method has been used by one of the members of the Standard Carbon Brush Holder Co., Ltd., for nearly 20 years.

With regard to the numerous other special features of the "Standard" carbon brush holder, there is no resemblance between the two types of brush gear.

These special points are:—

(1) The shape of the brush holder and of the supporting carrier is such that the position of the brush holder is absolutely definite in relation to the commutator. In the "Flather" arrangement the brush holder is clamped to a circular spindle, and therefore capable of circumferential movement round the spindle.

(2) The "Standard" brush holders are pulled up against an accurate face on the carrier, which definitely ensures the alignment of the holders and brushes. This feature is not shared by the "Flather" holder, with which alignment is a matter of hand adjustment.

(3) The "Standard" brush holder is so formed as to encase the clock spring, which is thus fully protected against "flash over." This arrangement has been standard for over fifteen years with several of the firms who have now adopted the "Standard" brush holder, but the "Flather" holder has not this feature.

(4) The method of adjusting the clock spring tension is quite different in the two holders. It is impossible to ensure uniform tension when adjustment is effected by turning a screw, as is the case with the "Flather" holder. With the "Standard" brush holder the adjustment is effected by means of a short lever, which is very accessible, easily operated with the fingers of one hand, and so arranged as to ensure uniformity of tension.

(5) Each "Standard" brush holder can be moved and replaced as a single unit without disturbing the adjoining brush holders and, due to the method of attachment, can only be replaced in the identical position from which it was removed. The "Flather" brush holder in general cannot be moved without disturbing the adjacent holders, while in certain cases it is even necessary to remove the supporting spindle also.

(6) The method of assembly which enables the "Standard" holder to be quickly separated into its component parts, also permits the fitting of a new part, such as a spring, in an exceedingly short time. The "Flather" gear is different in this respect also.

We do not wish to imply that Messrs. Flather's brush gear is badly designed. There are very many makers of electrical machines who have designed satisfactory brush gear, and we do not consider Messrs. Flather's design to be any better or any worse than a dozen other accepted types. The claim we make for the "Standard" brush gear is that it combines all the best points of existing designs, together with several quite distinctive features of its own. We have endeavoured to produce a brush holder "better than the best," and we feel that this object has been achieved.

Apart from the general features of design, which are common property, it is clear that improvements can only be the result of experience, and more experience has been available in this connection than has ever before been brought to bear upon the problem of brush gear. The fact that manufacturers with such experience and with existing designs of brush holders at least as satisfactory as any other on the market, have decided to substitute the new "Standard" brush holder for their previous designs—after many severe trials—is, we think, fairly conclusive evidence that the result of this collaboration is a brush holder superior to any other on the market.

The Standard Carbon Brush Holder Co., Ltd.

London,
November 30th, 1922.

Estimating for Internal Wiring Contracts.

In your issue of the 1st instant, Messrs. Lowdon Bros. and Co., and Mr. Basil A. Pilkington take exception to my criticism of the "price per point" method of estimating for internal wiring contracts.

Messrs. Lowdon Bros. confine their remarks to a statement that for the last 30 years they have made use of this method in all the contracts carried out by them; but such a statement is inaccurate, because their two contracts for the internal wiring of Redford Cavalry and Infantry Barracks, Edinburgh, carried out under my supervision, were neither scheduled nor measured up at the "price per point" rate.

Mr. Pilkington in a weak attempt to defend an indefensible system complains that I used an extreme case as an illustration but surely he will agree that the strength of a chain lies in its weakest link! Mr. Pilkington's attempted analogy of "rate per point" to cost of parcel post is deplorable; if only he could persuade the P.M.G. to adopt a "rate per package" irrespective of magnitude and weight the analogy would be perfect.

Mr. Pilkington, referring to "The Scottish Mode for the Measurement of Electrical Work," says, "the code was designed to be applied for work of any voltage"; will he now say why it was necessary to obscure the issue by bringing in the question of voltage? In what way does a varying voltage affect the measurement of definite lengths of wire?

In the preliminary rules of the Scottish Mode it is laid down that the "Schedules of Quantities shall fully, completely, and accurately represent the work to be contracted for"; can it possibly be contended that a "rate per point" falls within that rule?

Apart from certain anomalies, the Scottish Mode for the Measurement of Electrical Work, with Specific Rules Nos. 2 and 3 deleted, would be excellent and found capable of dealing with all internal wiring contracts for all voltages.

It would be interesting to know why "lighting points should be scheduled at a rate per point when "power points" are to be measured in detail under the Scottish Mode.

Alan Kirk.

London, *December 4th*, 1922.

Electric Lighting, Heating, and Cooking.

There are many letters, articles, and discussions reported in the electrical Press from time to time, almost all of which naturally emanate from those who are interested in the electrical business.

We showed a very nice range of electric irons, kettles and others of our manufactures at the recent Marine and Small Craft Exhibition held at the Agricultural Hall, and from the many conversations held with visitors we early realised that there was an opportunity to obtain the views of all kinds of people, as to why electrical appliances were not in more general use.

Careful notes were kept, and we found that:—

Seven per hundred had electric light.
Four per hundred had electric light and an oven.
Three per two hundred had electric light and a kettle.
Five per two hundred had electric light and a fire.
Only one had an electric cooker.

Almost unanimously the visitors would very much like to have electricity in their homes, but had heard that it was very expensive to obtain an installation. Those who had gone to the trouble to inquire the cost declared that they simply could not afford to pay the prices quoted.

When informed of what Poplar, Hackney, and Ilford were doing they were keenly interested, and there is very little doubt in our opinion, that the method being followed in these progressive boroughs, is the only way in which the boom in the electrical trade (which we all desire) will be achieved.

There are, no doubt, many local difficulties to contend with by those engineers whose duty it is to sell current and service, but the sooner they realise that a free wiring and rental scheme, organised in conjunction with their local contractors, is the only method by which they can interest all householders, the better for themselves and the trade generally. Obvious facts must be faced; the mass of the public cannot possibly bear the initial cost, but they want electricity, therefore it must be provided for them in a manner which appeals to them and which they can afford.

His Majesty the King paid a private visit to the Exhibition, and it was very noticeable what a really keen interest he took in everything; it brought vividly to our minds in relation to the foregoing remarks, what His Majesty said a few years ago: "Wake up, England!"

The Electric Heating Co.

Croydon, *November 27th*, 1922.

[Our correspondents made excellent use of their opportunity of collecting useful data, and we should be glad to receive further information of this kind.—EDS., ELEC REV.]

The Hastings Electricity Undertaking.

In your description of the Hastings undertaking at p. 777 of the ELECTRICAL REVIEW of November 24th there are two statements not quite historically accurate. The Hastings company commenced supply in 1883, not 1882. I was the Eastbourne Co.'s first engineer. That company commenced supply in September, 1882, and I know that the Hastings company was several months later.

The incandescent lamps supplied from Brush arc circuits in Hastings—as in Brighton and Eastbourne—were not in series of 20 across the 2,000 volts (the 100-volt lamp was not in commercial existence then), but in groups of lamps in parallel, the groups in series on the arc circuit, each group taking the arc circuit current. Arcs and lamp groups were on the same series circuits. This is obviously the only way to run incandescent lamps on a circuit, the characteristic of which is constant current and variable voltage. At Eastbourne we commenced with groups of eight 50-volt 16-c.p. lamps, each group taking the arc current of about 9.6 amperes. It was necessary to sort the lamps for equality of brightness and current. Eight lamps made an inconveniently large

group in many cases, and some lamps were specially made for us by Mr. Swinburne at the Hammond Co.'s lamp works to take about 3.2 amperes each, so that groups of three could be used. These lamps were of about 10 c.p., 12 to 15 volts. They were more convenient and economical. The switches short-circuited the groups. Meters were electrolytic, shunting the consumers' leads, so that they integrated volt-hours. They were "read" by weighing the cathodes.

The meters, switches, lamp-holders, and the cut-outs used to prevent the failure of one lamp in a group resulting in fireworks, were all home-made. Mr. Arthur Wright, at Brighton, was the pioneer in developing the fittings and devices used in this group-series system, but each of these three stations devised variations of its own.

The system was used shortly afterwards at some other places, *e.g.*, Cardiff, Windermere, and—if I remember aright—Chesterfield. I think it gave the idea for the "King-Beeman" system used at Colchester, subsequently developed into the so-called "Oxford" system, used also at Chelsea and Wolverhampton, where batteries were charged in series in sub-stations on a high-pressure constant-current circuit. But I did this in one of the Eastbourne hotels in the summer of 1883, charging the battery in the small hours of the morning from a Brush arc circuit, which I contrived to feed with about 25 amperes from a nominally 10-ampere machine, using automatic switches to cut out the arcs, and incandescent groups when the increased current started.

The Thury system is the highest development of this constant-current, variable-voltage, high-pressure system, and it is interesting to know that it is recognised as having possibilities even yet.

It will be remembered that this work was done before the a.c. system was available, and there was then no other commercially practicable way in which we could have supplied incandescent lighting three miles away from the station. But as soon as a.c. plant was available it put an end to progress with high-pressure direct current.

Nevertheless, there is still a surviving example derived from the early work above described in the Midland Railway stations and yards from Kentish Town to St. Pancras. It is not a series system, however. The dynamos at Kentish Town supply, at 2,000 volts, motor-generators in parallel in various sub-stations. It is not very long since that the Walsall undertaking was still using high-pressure direct current with battery and motor-generator sub-stations.

I can say that the familiarity with high pressures gained while working this series system proved very useful when the a.c. plant had to be handled; the engineers who had been brought up on it knew more about insulation than those who had only known 100 volts from earth.

Board of Trade regulations for the public safety were still in the future. The first time that Major Cardew inspected one of these series systems he was deeply grieved, and ordered it to be shut down. Yet we supplied shops, hotels, and some private houses in this way without catastrophe. The fire insurance people were a little puzzled by it. They could not understand why we put in no fuses; but after I had demonstrated to one inspector that a short circuit on the station switchboard resulted in an instantaneous cessation of current I had no further trouble, though I do not say that he understood. The arc machines had automatic regulators, which kept the current nearly constant, and if the circuit conditions led to a quite small increase in the current the machine flashed over and lost voltage.

Such were some of the beginnings, forty years ago, brought to mind by your Hastings article, when the Electrical Review was still young, but already the valued weekly instructor of,

Henry M. Sayers.

London, *November 29th*, 1922.

Steam Condensing Plant.

In Messrs. Fothergill's last letter appearing in your issue of December 1st, I am glad to see that they do not now insist on a test being carried out on a commercial plant, and no doubt they have realised that this would be useless as a reliable guide to ascertain the high efficiency of the Delas air extractor.

I feel sure that these gentlemen cannot have been so ill-informed as not to have thought of a much more simple test of an extractor alone without its condenser, but no doubt, and very judiciously, they considered they could not well ask for such a test; and I very much doubt if they could persuade any British manufacturer to deliver a jet to them for testing purposes, as it is a very exclusive trade, and results have been obtained only at the expense of much time and money in experimental work, but again I must inform Messrs. Fothergill, that I have no authority to speak or sell in the name of La Société des Condenseurs Delas, and I believe that this firm cannot even sell its own apparatus in England.

In reply to the final part of Messrs. Fothergill's letter, I should like to make it clear that Mr. Delas actually invented the jacketing of the extractors, and when he made the discovery had not even heard of the old fireman who put his wet rag on the boiler injector.

In conclusion, I should like to say that I feel we have already taken up rather more of your space than the case merits, and that nothing can be gained by continuing this correspondence. I must, however, repeat that the steam consumption figures were based on tests carried out by an eminent consulting engineer who has had exceptional opportunities of testing the leading steam-jet air extractors, and when all is said and done, although important, it is not only economy that counts. The engineer in charge is much more concerned about the stability and all-round efficiency of his apparatus, and those of the Delas air extractor are well shown by the way that modern power stations and leading firms have adopted it, not only in France (in stations such as Gennevilliers), but all over the world.

R. Velut.

Wembley, *December 4th*, 1922.

[This correspondence is now closed.—Eds. Elec. Rev.]

The Improvement of Power Factor.

In perusing your valuable journal of November 24th, I notice during the discussion on the late Dr. Kapp's paper on the above subject, that Mr. W. E. Rogers considers that the use of static condensers is not a commercial proposition at a lower pressure than 600 volts. The writer previously to installing this method of power-factor improvement inspected several installations working at from 400 to 550 volts, all of which had given perfect satisfaction from the point of view of reliability, and the resultant saving effected by their installation for the improvement of the power-factor of the system in question.

C. Jones.

Applications to Box Numbers.

On reading the letter written by "Practical Engineer," I felt I should like to send you a few lines to say that, with regard to obtaining situations in reply to box numbers, my experience has been just the reverse of "Practical Engineer's." For instance, a few years back I desired a change and improvement in my position, and replied to two advertisements which appeared over box numbers in two consecutive issues. I heard nothing from the first, but received a reply to the second and got the job; efficiency therefore 50 per cent. Again, this year, I desired another change and step up, and replied to three advertisements, which appeared over box numbers in issues close together; result, no reply to the first (for which I was unsuited, and which was a job beyond me); replies to the other two asking for an interview; lost the second job and got the third; efficiency 66⅔ per cent.

I have occasionally in the interval "had a shot" for a job asking for a salary higher than I expected to get, just to see if anything did come of it, without receiving any reply, but what I am trying to point out is that on two occasions when I have definitely desired a fresh job I've been fortunate enough to obtain it soon through the advertisements in the Electrical Review. Further, in the cases when I've received no reply, I've never had my confidence broken.

I would like to suggest to "Practical Engineer" that men advertise for positions as well as employers for men, and I'm quite sure that very few men in jobs with which they are not satisfied would like to advertise for another job without using a box number. Conversely, in the case of an employer who has an important man with whom he is not satisfied, he can hardly be expected to advertise the fact that he intends to make a change without first ascertaining whether a more suitable man can be found.

Fortunate.

December 2nd, 1922.

"Practical Engineer" has brought up an old grievance which has the writer's sympathy, but one which I am afraid will not be remedied till labour is at a premium. Why can't would-be employers take a tip from our esteemed journal, the Electrical Review, and assume a sense of fairness? Having had similar experiences to your correspondent, I have long since ignored box numbers, and also the gentlemen who add the nauseating words to their advertisements: "state salary required." Like "Practical Engineer," I feel sure that if employers would come out into the open they would get many more replies to their advertisements, and the results would be much more satisfactory to the employers themselves, besides giving the applicant more confidence.

Another Engineer.

December 2nd, 1922.

[We think no useful purpose will be served by prolonging this discussion.—Eds. Elec. Rev.]

International Electro-Technical Commission.—Correction.—Owing to a printers' error the note bearing the above heading in our last issue was made to read "to consider the acceptance of the 40 per cent. rating with overload." The reference was, of course, to temperature rating, and the wording should have been "40 degrees."

BUSINESS NOTES.

The "Electrical Review" Issue for December 22nd.—The attention of advertisers and readers is directed to an announcement appearing in our advertisement pages to-day respecting the dates for sending in copy for our issues of December 22nd and 29th. Will correspondents and other contributors take note that for the issue of December 22nd all editorial matter for publication must reach us a day earlier in the week than usual?

Bankruptcy Proceedings.—FRANCIS LEOPOLD PERRIN, electrical engineer, Northampton.—The first meeting of creditors was held at Northampton last week. The statement of affairs, showing a deficiency of £2,129, appeared in last week's REVIEW. The Official Receiver (Mr. J. Osborne Morris), who presided, said that whether the assets would realise as much as the debtor estimated, was problematical. He had frequently found that debtors under-estimated their liabilities and over-estimated their assets. There were several claims by money-lenders, and there was no doubt that debtor ought to have filed his petition long before he did. It was decided that debtor should be adjudged a bankrupt, and Mr. H. C. Palmer, Kingham Chambers, Abingdon Street, Northampton, was appointed trustee, with Messrs. W. J. Barnes, F. S. Day, and H. Adams (General Electric Co.) as a committee of inspection. The larger trade creditors were :—

	£		£
Alden Engineering Co. ...	31	Metallic Engineering Co. ...	78
Anti-Vibration Co.	27	Napier Kimber	94
B.T.T. Lamp Co.	99	A. R. Reeve	100
F. S. Day	46	Ruston & Hornsby	18
Dowding & Mills	17	Royal Fortuna	84
English Electric & Siemens Supplies	120	Roberts & Co.	12
Electric Supplies	30	Siemens Bros.	19
General Electric Co.	276	Smith & Co.	26
B. Harris	200	Sun Electrical Co.	20
Hands, Ltd.	18	Tudor Association	146
Hoover Pristien Co.	19	Veritys	21
Johnson & Wright, Ltd. ...	73	Walsall Hardware	57
Jeary Electrical Co.	65	Webber	32
Johnson & Phillips	30	Price & Son	18

H. BUSFIELD and J. J. WHITTAKER (Busfield & Co.), electrical engineers, 6, Wilfield Street, and late of 215, Padiham Road, Burnley.—First meeting December 9th, at the Official Receiver's offices, Preston. Public examination December 12th at the County Court House, Burnley.

S. BECKETT, JUNR., electrician, 50, Deane Road, Bolton.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released November 24th.

W. SHAW, THE YOUNGER, electrical engineer, 26, Westcliffe Road, Shipley.—Last day for proofs for dividend December 16th. Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford.

J. OWEN (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich.—Second and final dividend of 1¼d. in the £ payable December 18th at 29, Russell Square, W.C.

Company Liquidations.—VARLEY MAGNET CO., LTD.—Winding up voluntarily, the company having disposed of its business to Oliver Pell Control, Ltd. Liquidator, Mr. R. Crane, 46-47, London Wall, E.C. Meeting of creditors, December 15th. Particulars of claims to be sent to the liquidator forthwith.

OLIVER PELL ELECTRIC AND MANUFACTURING CO., LTD.—Winding up voluntarily, the company having disposed of its business to Oliver Pell Control, Ltd. Liquidator, Mr. R. Crane, 46-47, London Wall, E.C. Meeting of creditors, December 15th. Particulars of claims to be sent to the liquidator forthwith.

With reference to the above notices, Messrs. Oliver Pell Control, Ltd., write stating that these liquidations "are merely formal and occasioned by the fact that an amalgamation of the two companies was made some time ago under the title of Oliver Pell Control, Ltd., for greater convenience and economy in working, the two companies having been so intimately connected during the past 20 years. The management remains the same, and there will be no change of policy." The Varley Magnet Department is exceedingly busy in all classes of coil winding, including that for wireless broadcasting sets, while the Oliver Pell Department is actively engaged in executing orders for its distant control system of switching and other manufactures.

A.C. SPARKING PLUG CO., LTD.—Meeting of creditors, December 9th. Particulars of claims to the liquidator, Mr. H. C. Fuller, The Hyde, Hendon, by January 5th.

SPLITDORF ELECTRICAL CO., LTD.—A meeting of members is called for January 8th at Messrs. Hickman & Randall's offices, Coventry House, South Place, E.C., to hear an account of the winding-up from the liquidator, Mr. H. J. Hinley.

STANDARD CABLE MANUFACTURING CO., LTD.—First and final dividend of £11 15s. 4½d. per share, payable at Carey Street, W.C.

STRACHAN, OSWELL & CO., LTD., exporters and importers, 45, Kingsway, London, W.C.2.—Voluntary liquidation. Messrs. W. W. Read and H. Kidson joint liquidators.

Dissolution of Partnership.—CHAS. ROBERTS & CO., automobile and electrical engineers, The Grange, New Scarborough, West Ardsley.—Mr. C. Roberts and Mr. T. Bailey have dissolved partnership. Debts will be attended to by Mr. T. Bailey and Mr. H. Johnson, of The Crescent, Britannia Road, Morley, who will continue the business in co-partnership.

Trade Announcements.—THE ENTERPRISE MANUFACTURING CO., LTD., has been appointed sole London and export agents for the Imperial Engineering Co., of Wolverhampton, manufacturers of "Imperial" fires, hotplates, toasters, and geysers. It is holding stocks at its premises in Grape Street, Shaftesbury Avenue, W.C.2.

MESSRS. CORLETT BROS. have commenced business as electrical engineers at 42, Tynwald Street, Douglas, Isle of Man.

The businesses of TREVELYAN & CO. and C. H. DAVIES & CO., LTD., have now been amalgamated, and will in future be carried on under the name and title of Trevelyans (Birmingham), Ltd. Messrs. T. Gladdy and T. Reynolds are directors of the new company, the registered offices and works of which are at 155, Bracebridge Street, Birmingham, where the company will continue the manufacture of "Treva" lampholders and accessories. A new catalogue is in the press. The company's London office is at 70, Newman Street, Oxford Street, W.

MESSRS. PETTIGREW & MERRIMAN, LTD., of Tooley Street, S.E.1, sole distributors for the Ashley Wireless Telephone Co., Ltd., and the Automatic Telephone Manufacturing Co., Ltd., of Liverpool, for London, Home Counties, and South Wales, announce that they are opening a retail store and demonstration room at 54, Gracechurch Street, E.C.3.

The business of SHAND, MASON & CO., fire-engine makers, of Blackfriars, has been purchased by, and is now incorporated with Merryweathers, of Greenwich.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., announce that the British Thomson-Houston Co., Ltd., and the General Electric Co., Ltd., are now associated with them. This connection is for the development of X-ray and electro-medical apparatus constructed on established electrical engineering lines, and, with the aid of the research laboratories of these companies, the incorporation of the most recent advances in physics. Mr. C. H. Holbeach, previously in charge of the Coolidge Tube Department of the British Thomson-Houston Co., Ltd., is joining the company's staff. The management of Watson & Sons will be unchanged.

MR. E. GOLDSTON, electrical and heating engineer, has removed to 58, Marefair, Northampton, and has taken his manager, Mr. Garratt, into partnership. The business will be known as Goldston & Co., and lists of electrical manufactures are desired.

THE CALPHOS ELECTRICAL CO., LTD., has moved into larger premises at No. 70, Victoria Street, Westminster, where it is demonstrating its specialities, including the Calphos flashing adapter and signs, of which it is the sole manufacturer.

MESSRS. BERRY'S ELECTRIC, LTD., are removing their Manchester branch from King Street to Touchbutton House, 5, Deansgate, where, when completed, they will have extensive showrooms on the lines of their House in Newman Street, London.

THE LONDON ELECTRIC FIRM has purchased from Messrs. Henry Williams, Ltd., of Darlington, the branch of their business recently trading as the Arc Lamp Lowering Gear Co. (and formerly as the North-Western Appliances Co., of Cathcart, Glasgow), including the whole of the designs, patterns, entire stock, tools, jigs, drawings, patent rights, and goodwill.

MESSRS. BARRATT BROS., electrical engineers and contractors, 48a, Baxtergate, Whitby, Yorks., are opening showrooms, and they desire to receive catalogues and lists of domestic electric lighting and cooking appliances, wireless apparatus, &c.

The name of A.G.E. ELECTRIC MOTORS, LTD., Stowmarket, has been changed to Bull Motors, Ltd.

Catalogues and Lists.—MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list (December) of d.c. motors ranging from 1 to 50 h.p.

THE ELECTRICAL ALLOY CO., 4, Regent Square, Gray's Inn Road, W.C.1.—A leaflet advertising "Calido" resistance wire for electric heating and cooking appliances.

THE PEAK ENGINEERING AND SUPPLY CO., 17, Red Lion Passage, Red Lion Square, W.C.1.—A pamphlet illustrating and describing the "Castle" fine adjustment valve for the micrometric control of the flow of fluids.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A comprehensive catalogue dealing with electrical equipment for ships. The list includes lighting fittings, switchgear, heating and cooking appliances, wireless equipment, electric tools, &c.

RECESS SCREWS, LTD., Gillingham, Kent.—An illustrated pamphlet advertising screws with recessed heads, and special screwdrivers for these.

CABLE ACCESSORIES CO., LTD., Britannia Works, Tividale, Tipton, Staffs.—Progress sheet No. 58, dealing with "Revo" ceiling fans and reproducing a Faraday House report; also a folder advertising the "Revo" electric iron.

MESSRS. FERGUSON, PAILIN, LTD., Edward Street, Higher Openshaw, Manchester.—Catalogue Section 66/A1, an illus-

trated list of pole-operated isolating switches of various types for currents ranging from 200 A. to 2,500 A. up to 11,000-V pressure.

THE HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, E.15, has circulated a small blotter bearing particulars of its business and manufactures.

SUPERLAMP, LTD., 197, Old Street, E.C.2.—A net trade price list of cables, wires, tumbler switches, wall plugs, conduits, &c.

MR. M. W. WOODS, 146, Bishopsgate, E.C.—An illustrated and priced pamphlet dealing with small rectifiers for battery charging.

WHITWORTH ELECTRIC LAMP CO., LTD., 195, North End Road, West Kensington, W.14.—A net trade price list of electrical accessories, including lighting fittings, switches, bells, batteries, conduit cables, and wires.

MESSRS. ED. BENNIS & CO., LTD., 28, Victoria Street, S.W.1.—A well-produced brochure containing numerous views of installations of coal- and ash-handling plant in power stations, &c.

X-RAYS, LTD., 11, Torrington Place, Gower Street, W.C.1.—A circular letter announcing reductions in the price of "duplitised" photographic films.

CREDENDA CONDUITS CO., LTD., Whitehouse Street, Aston, Birmingham.—A well-illustrated catalogue of "Creda" heating and cooking apparatus. Fully priced.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. (Engineering Department), Blomfield Street, London Wall, E.C.2.—Publication W.L. 2A, a pamphlet illustrating and describing the "Isco D" loop-in cut-out.

MESSRS. MAY & PADMORE, LTD., Wharfdale Road, Tyseley, Birmingham.—A priced catalogue of "Maymore" electric fires, irons, kettles, hotplates, &c., illustrated in colours.

THE CAMBRIDGE & PAUL INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card advertising the "Omega" insulation testing apparatus.

THE OVERSEAS ENGINEERING CO., LTD., 68-70, Great Eastern Street, E.C.2.—A number of pamphlets dealing respectively with automobile lamps; "Zenith" low-speed oil engines; "National" d.c. motors and dynamos; and the "Overseas" small lighting and power plant.

Electricians' Wage Reduction.—The members of the N.F.E.A. have been notified that the result of the ballot vote of the Electrical Trades Union was in favour of acceptance of the second 5 per cent. reduction on the April, 1921, rates. The reduction will take effect on the first pay-day following January 7th, 1923, for the period covered by that pay-day, when the rates per hour will be as follows:—Grade A, 1s. 8¼d. (this rate includes a travelling allowance); Grade B, 1s. 6¼d.; Grade C, 1s. 5d.; Grade D, 1s. 3¼d.

Correction.—The Metropolitan-Vickers Electrical Co., Ltd., asks us to correct an error which occurred in its advertisement on p. 15 (supplement) of our last issue. The price given as £5 should have read £4 10s.

The British Empire Exhibition.—We have already published a good deal of information regarding the arrangements that are being made for the great British Empire Exhibition at Wembley Park from April to October, 1924. We have concentrated more particularly on the electrical and engineering arrangements, and we emphasise the importance of these and the need for prompt action on the part of would-be exhibitors in our "Leader" pages to-day. Since our last extended reference to the Exhibition we have received a grey-covered booklet of 68 pages in which are set forth fully the names of vice-presidents, members of the Executive Council, and the officials, and particulars of the numerous groups in the general classification of exhibits. Copies of this booklet should be obtained (from the general offices at 16, Hobart Place, London, S.W.1), as readers may be interested in lines that presumably do not come in the Electrical and Engineering Hall. For instance, the additional groups include railways and tramways, postal, telephonic and telegraphic services, lighting, heating, and ventilation, photography, kinematography and radiography, and so on. In addition, we have received certain information respecting the work of the Scientific Instruments Committee, of which Sir W. Napier Shaw is chairman, and Sir Joseph Petavel deputy chairman. This is one of the many technical and scientific committees now at work on the organisation of exhibits.

With regard to the classification of exhibits, two methods have been suggested by the National Physical Laboratory:—(1) Under branches of science; (2) under types of instruments. It is possible that the exhibits coming within the scope of this committee will require between 10,000 and 20,000 sq. ft. of space, but the precise area cannot be ascertained just at present. The Committee is in touch with the various firms who are likely to be exhibiting. Special attention will be paid to the optical section of the trade, as well as to the magnetic, meteorological, and general sections. There is a possibility, we understand, that the Royal Society, as a measure of support for the Exhibition, may decide to form a committee to deal with pure science. For this work special funds would be needed to meet expenditure; but the activities of such a committee would in no way trench upon the work of the Scientific Instruments Committee.

On behalf of the Department of Scientific and Industrial Research, several nominations have been made to the Exhibition Committee on the application of Science to Industry. Other nominations have been made by the British Research Association for the woollen and worsted industries, and other bodies. Labour is also represented on the Committee.

In regard to the progress that is being made with the Exhibition buildings and grounds generally, we are informed that up to the end of November the following quantities of various materials had been used:—

Cement, 6,800 tons; ballast, 35,400 tons; bricks, 360,000; ashes, 14,200 tons; coal, 1,975 tons; sand, 5,400 tons; roofing, 3,000 squares; reinforcing steel, 1,350 tons; constructional steel, 1,350 tons; drain pipes, 36,000 feet.

The number of men employed was 1,200.

An Executive Committee representing all the States had been appointed to deal with Australia's participation in the Exhibition. With regard to the erection of a pavilion, plans are being prepared by officers of the Public Works Department, who are going to London to supervise the arrangements. Sub-committees have also been appointed to deal with publicity, finance, and shipping matters.—*Reuter* (Melbourne).

Book Notices.—"Common Commodities and Industries: Incandescent Lighting," by S. I. Levy, B.A. (129 pp.; 29 plates). London: Sir Isaac Pitman & Sons, Ltd. Price 3s. net.—The greater part of the matter in this work is historical in nature, and gas illumination, probably on account of its greater age, receives more space than electric lighting. There is an interesting chapter upon the rare earths, followed by a description of the manufacture of incandescent gas mantles. Comparatively scanty treatment is afforded the electric incandescent lamp, the actual manufacture being confined to two plates showing, respectively, a filament spiralising machine and a sealing-in machine. In Chapter V the author makes a comparison between modern methods of lighting. He frankly admits that his table of comparative costs is subject to many fluctuating considerations, but he has endeavoured to give fair and representative figures, although this is extremely difficult where the prices of gas and electricity cover such a wide range. Mr. Levy considers the hygienic superiority of electric over gas lighting "not proven" to any appreciable extent, and considers that the application should decide the choice of illuminant.

"Lubrication and Lubricants," by J. H. Hyde, A.M.Inst.C.E. (114 pp. 37 figs.). London: Sir Isaac Pitman and Sons, Ltd. Price 2s. 6d. net.—Commencing with the function, types, and applications of lubricants, the author gives a short study of the nature and manifestations of friction, including fluid friction and viscosity. He then briefly outlines the theory of lubrication, following this with descriptions of tests of lubricants—mechanical, physical, and chemical—which occupy comparatively large space. The use of solid lubricants is confined to a brief chapter, but recent developments are treated at greater length. Concise but clear descriptions of the Michell thrust and journal bearings appear in the last section, together with illustrations and diagrams. The results of recent researches into the nature and properties of lubricants are reviewed, and the final chapter presents a number of every-day examples of lubrication, including descriptions of force-feed pumps and other mechanical lubricators.

"Railway Signalling: Automatic," by F. Raynar Wilson (116 pp.; 75 figs.). London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.—The author, who is assistant engineer of the Victorian Government Railways, in his opening chapter states the case for automatic signalling, pointing out that such a stage has now been reached that failures due to defective design are a negligible quantity, and other failures are extremely rare. Track-circuiting is dealt with in the two following chapters—both steam and electric railways being considered. Subsequent chapters deal with: Locating and spacing signals; electro-pneumatic, electro-gas, and low-pressure pneumatic signals; all-electric two- and three-position signals; and light signals. The numerous illustrations are successful in conveying to the reader's mind the nature and appearance of the apparatus dealt with, and a comprehensive bibliography and index appear at the end of the volume.

M. Albin Michel, 22, Rue Huyghens, Paris (14), has sent us two lists of technical and scientific works of which he is the publisher. One list covers electrical and mechanical engineering, mining and metallurgy, architecture, transport, &c., while the other describes the contents of the electrical and mechanical engineering works included in the first list.

From Messrs. S. Reutell & Co., Ltd., we have received a list of books dealing with all branches of electrical engineering. A number of books recommended by the City and Guilds examiners is the main feature.

The Stafford electrical engineer (Mr. R. H. Robins) has sent us a souvenir booklet containing a note of the proceedings at the recent official inauguration of the plant extensions by the Mayor. A photograph of those present forms a frontispiece.

"Bulletin Oerlikon," August, September, and October, 1922. London: Ateliers de Construction Oerlikon.—The first of these three numbers gives a brief illustrated description of the St. Lary (Pyrenees) power station, and an article on eddy current losses in the copper conductors of electrical machines and transformers. The September issue describes the Herlandsfossen (Norway) station, and gives full details of the design and construction of the generators, and another article deals with the Jogne (Switzerland) hydro-electric station. In

the October number an electric overhead conveyor at a steelworks is described, and there is also an article upon mainline railway electrification in France.

"The *Journal* of the South African Institution of Engineers." November, 1922. Price 2s.—The paper reproduced in this issue is "The Tipping and Guiding of Vertical Skips," by G. W. Sharp, together with discussion. A list of recent Union patents also appears.

"Industrial Applications of X-Rays," by P. H. S. Kempton. Pp. xiii+112. London: Sir Isaac Pitman & Sons. Price 2s 6d. net.

"Discoveries and Inventions of the Twentieth Century," by E. Cressy. Second edition. Pp. xxiii+458; figs. 342. London: G. Routledge & Sons. Price 12s. 6d. net.

"Experimental Electricity and Magnetism," by S. E. Brown. Pp. vii+221; 193 figs. Cambridge: University Press. Price 5s.

We understand that *La France*, a new paper introduced by Messrs. Evans Bros., Montague House, Russell Square, W.C., for readers who are learning the French language, and referred to here previously, has been so successful that the publishers are now issuing a new paper, *L'Echo de France* (Price 1d.), in much more simple language for beginners. Specimen copies of both publications will be sent to our readers on application to the foregoing address.

Armstrong, Whitworth and the B.T.H.—We hear that arrangements have been made by Sir W. G. Armstrong, Whitworth & Co., Ltd., and the British Thomson-Houston Co., Ltd., of Rugby, with the object of undertaking jointly the complete electrification of railways and the manufacture of all types of electric locomotives and rolling stock. These companies hope to receive an important share of the railway electrification schemes now under consideration, thus helping to provide much-needed work for a large number of men on Tyneside and at Rugby in the near future. The locomotives and rolling stock will be constructed at Messrs. Armstrong's Scotswood Works. The potential output of heavy main line steam locomotives from these works is stated to be 450 a year, and large numbers of engines for both home and foreign railways have been constructed there since the war. The British Thomson-Houston Co., Ltd., with its various factories, will, it is understood, be able to provide all the electrical equipment and machinery which will be required, not only for the locomotives and rolling stock, but for the power stations and substations as well.

Social.—The annual whist drive and dance of the Blackpool Corporation Electricity and Tramways Employés' Institute was held recently. Over 1,200 people sat down to whist, whilst for dancing there were about 2,000 present.

The Rand Strike.—The Mining Industry Board, appointed after the strike of the Rand miners to investigate the state of the mining industry, has issued its report. This was reviewed recently in the *Financial Times*. After stating its conclusions with regard to the gold mines—the native labour question, efficiency, &c.—the Board deals with the coal-mining industry. It is of the opinion that the wage reduction proposed by the employers was justified, but the miners acted properly in giving a month's notice of stoppage, and the Board can understand their refusal to proceed to arbitration. With reference to the Victoria Falls Power Co. dispute, the Board declares that upon the whole the men were not justified in demanding an increase, and the company was right to reject it. The question of higher pay for Sunday work, however, was a matter for further negotiation, and the company was unwise to refuse to call a conference to discuss the matter. The report outlines conciliation boards for the various industries concerned, and expresses the opinion that trade unions should be registered, and that any vote of workmen which may result in a stoppage of work should be secret and held under the supervision of a Government department.

French Metallurgical Conditions.—The Société Electro-Metallurgique de Dives reports that the net profits declined from 4,397,000 fr. in 1920-21 to 2,765,000 fr. in 1921-22, although the dividend is maintained at the rate of 60 fr. per share. The directors state that the diminution in the profits was due not solely to a falling off in business, but also to general considerations. For instance, the wages paid to the workmen were now more than three times the amount of the profits distributed on the share capital, and they formed a greater part in the cost of production. The high increases in the cost of railway transport also brought about a notable decrease in the profits by placing a burden on the cost of production in a proportion representing not three times, as many persons believed, but often from five to six times the pre-war figure. In addition, the taxes and State imposts were crushing, the amount affecting the company in 1921-22 having exceeded 2,000,000 fr. These new burdens, for which it was impossible for industry to find compensation in an augmentation in the sale prices, were the result of dispositions voted by the public authorities, who were too much inclined to the tendency of making a single class of citizens bear the imposts. At present the portion of the profits remaining to the shareholders did not represent more than one-sixth of the total of wages, cost of transport, and taxes combined. In conclusion, the directors state that this situation of affairs, which it was hoped would only be transitory, could not continue without being dangerous.

Local Exhibitions.—The recent electrical exhibition at Poplar met with a large measure of success. Although only 10,000 visitors were expected, 20,700 attended during the week, and on many occasions there were queues waiting for admission. These results were remarkable, as there were a number of adverse circumstances to be met—including the excitement of the General Election. The electric bakery showed a profit of £103, although the current prices were charged. This balance was sent to the Poplar Hospital. Another centre of interest was a working man's electric kitchen in charge of Mrs. Hunt, the wife of the Council's mains foreman. The borough electrical engineer (Mr. J. H. Bowden) and his assistant (Mr. F. Tait) are to be congratulated upon the results.

At the Blackpool "Ideal Homes" Exhibition, Messrs. R. Darbyshire, Ltd., had three stands on which they displayed everything from electric lamps to a complete wireless telephony installation. Amongst their exhibits were electric washers, vacuum cleaners, fires, ranges, irons, boiling rings, and electric light installations. The firm also made a feature of its "Exide" battery service.

Unemployment.—The following are the details of unemployment compiled from Employment Exchange registers, as on November 27th:—Wholly unemployed, 1,387,400, increase 8,382, short-time workers, 53,200, increase 2,200.

The State of Swiss Industry.—In the report of the Swiss Engineers' Union on the year 1921, the complaint was voiced that the importance of the export industry to Switzerland's well-being was wholly under-estimated by Government officials, and the industry's taxibility was overrated. It was a matter for thankfulness that the Federation scheme for the electrification of the railways, notwithstanding the unfavourable financial situation, was still being actively pursued. In the home market the principle must be more and more insisted upon that what could be manufactured at home must be ordered in the home market in order to improve the industrial situation. For the outside market the question of rise in quality in particular was a subject for consideration. Hope in this direction was afforded by the fact that in the countries with depreciated currency, and in Germany in particular, prices were hastening towards the level of the world market. When this point was reached it would be Switzerland's opportunity, with its sound currency, to work again under normal conditions. As to foreign trade, the aggregate volume of imports was 28,550 tons (against 52,154 in 1920 and 31,391 in 1913), of which 530 tons represented electric generators (against 380 and 751 in the years forenamed); steam engines and turbines, 521 tons (against 355 and 763); and fuel power motors, 201 tons (against 326 and 192). In power machines of all kinds and electrical machines and apparatus, the import figures with such a highly-developed industry were very small indeed. The aggregate volume of exports reached 49,397 tons (against 66,778 and 56,667), of which dynamos figured for 7,154 tons (against 6,657 and 7,936); steam engines and turbines, 3,852 tons (against 3,249 and 5,595); and fuel power motors, 4,769 tons (against 7,668 and 6,372). About half the imports, but only 1.8 per cent. of the exports were German.

Copper and Lead Prices.—Messrs. F. Smith & Co. report December 6th:—Copper (electrolytic) bars, sheets, wire rods and h.c. wire, no change.

Messrs. James & Shakespeare report December 6th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £27 5s., 5s. decrease on last week's quotation.

Chinese Notes.—Lu Wen-mei, a merchant of Chuanshahsien, Kiangsu, and others have petitioned the Ministry of Communications for the registration of the Ta Chuan Electric Light Co., Ltd. They propose to organise with a capital of $20,000. The request was granted providing that the erection of the plant was commenced within six months' time from the date of the grant.

The Chapei Hydro-Electricity Co., Ltd., promoted by Shen Lien-feng and other notable merchants at Shanghai, is now issuing capital to the extent of $3,000,000 in 300,000 shares of $10 each. The company will carry on the water, electricity and tramway systems in the locality. Its preparation bureau is, at present, situated at Tienchili, Paoshan Road, Shanghai.

The Ministry of Communications has registered the establishment of the Kienyang Electric Light Co., in Fukien, which was proposed by Chen Shou-sin and other local merchants of the district.

Diary.—We have received from Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, one of their Simplex diaries for 1923. Instead of the customary fast-bound booklet they have this time adopted an inset diary and a loose solid calf cover. The diary is essentially one for engineers, sectional ruling being retained throughout. In some cases new tables have taken the place of old ones, and those renewed are checked and revised where necessary. Where prices are subject to fluctuation these are, of course, only corrected up to the time of going to press; they can always be checked on application to the company.

Improvement in Swedish Electrical Industry.—The heavy depression which marked 1921 in the Swedish electro-technical industry is abating, says the Swedish *Teknisk Tidskrift*. Both employment and orders are increasing. The

state of affairs in 1921 was such that the number of workmen employed fell from 7,500 to 3,500, with shorter hours, the loss being equivalent to 19,000,000 kronen, or 10 per cent. of the capital. While the cost of living remained at 80 per cent. above pre-war level, the price of products had to be reduced 20 per cent. below, in order to find buyers. The chief causes were the retrenchment of enterprises owing to the falling prices and the high level of the kronen, which throttled the exports and favoured the countries with depreciated currency, with which such legislation as was passed only weakly grappled. The successful issue from the crisis is solely to the credit of the industry itself, which has carried on with reduced establishments and at great sacrifices.

A Finnish Contractors' Association.—The Finnish Association of Electrical Contractors, which has just celebrated the tenth year of its existence, now numbers 26 firms in different parts of Finland. The Association has supported its members in the case of labour disputes, maintained statistics with regard to wages conditions, expressed opinions concerning legislation proposals, and organised courses of instruction for fitters which are supported by the State.

Trade Commissioner for Nairobi.—*The Times* Nairobi correspondent learns that the Trade Commissioner " is expected to return to duty in January, and that the indications are that the post will be maintained. It was recently proposed to discontinue it for reasons of economy."

LIGHTING AND POWER NOTES.

Australia.—Burrinjuck (N.S.W.).—It is announced that a start is to be made this year with the Burrinjuck hydro-electric scheme. The Burrinjuck dam was built for the dual purpose of providing water for irrigation and of developing hydro-electric power. A dozen towns over a wide area will be supplied with cheap light and power, and it is anticipated that important industries will be established in consequence. Mr. Ball, Minister for Works, states that plans and specifications are in preparation, and tenders will be called for the supply of machinery. Practically all the preliminary work in connection with the scheme has been completed, including the survey of the transmission lines. The following are the chief towns concerned in the scheme:—Jugiong, Cootamundra, Gundagai, Junee, Wagga, Harden, Murrumburrah, Young, and Yass. The work will be carried out in stages, and there is no complete estimate of the whole scheme. The initial work will be the construction of the off-take tunnel from Burrinjuck to the power house and the foundations of the power house. Tenders will be invited for this work, and separate tenders for the turbines, switchgear, transformers, &c.—*Reuter's Trade Service* (Melbourne).

Rockhampton.—The Queensland Premier has sanctioned the borrowing of £70,000 for an electricity scheme.

Burgess Hill.—Special Order.—The Burgess Hill and District Electric Supply Co., Ltd., is applying to the Electricity Commissioners for an Order authorising it to generate and distribute electrical energy for public and private purposes within the urban district of Burgess Hill and portions of the parishes of Wivelsfield and Ditchling, Cuckfield rural, Keymer and Clayton, and Hurstpierpoint.

Berwick.—Electricity Charges.—The Electricity Commissioners have sanctioned an application by the Urban Electric Supply Co. to fix the maximum charge for electricity at 1s. per kWh.

Cheadle and Gatley.—Electricity Supply.—The Council has arranged to obtain a supply of electricity from the Manchester Corporation, and a sum of £10,000 is to be borrowed to meet expenditure.

Continental.—Germany.—Referring to the strike of the workers of the Baden Aniline Works at Ludwigshafen, the Ludwigshafen correspondent of *Die Zeit* states that the French Occupation Authorities have ordered work to be continued in the vital industries. This order affects, among others, the workers in the Ludwigshafen electricity works, who had declared a sympathetic strike with the workmen of the Baden Aniline works.—*Reuter* (Berlin, December 1st.)

Czecho-Slovakia.—According to *El Obzor*, an electro-technical year-book for 1922, the number of private electricity works existing in the Republic is 255. The public undertakings are 146 in number, with a total capacity of 210,530 h.p. Of the total, 104 (equal to 251,660 h.p.) are steam driven; 93 (14,300 h.p.) water driven; 30 (12,360 h.p.) are equipped with Diesel engines; and 15 (1,010 h.p.) with gas engines. The capacity of the undertakings ranges from 50 to 50,000 h.p., there being five steam-driven plants between 5,000 and 10,000 h.p. and six between 10,000 and 50,000 h.p.; the highest of the other forms of power production does not exceed 5,000 h.p. The current generated is continuous in the case of 202 stations (51,116 h.p.) and alternating in the case of 157 stations (331,850 h.p.), 42 being of mixed character (58,025 h.p.). The nationality of these undertakings is not wholly Czecho-Slovakian, over half being returned as German and Hungarian, having been established before the war in most cases.

Belgium.—The recently-formed Société Générale Belge de Distribution Electrique has secured the concession for the supply of electricity for lighting and power purposes in Ypres.

Criccieth.—Electricity Supply.—The Town Council has decided to take steps to light the town by electricity.

Glasgow.—Extension of Supply.—The Corporation Housing Committee has agreed to an overhead system of electric lighting at Sandyhills.

Horsham.—Year's Working.—The accounts of the electricity department (engineer: Mr. F. Ffrench) for the year ended June 31st last, show a total income of £9,474 as compared with £8,580. Working expenses amounted to £6,830, as against £5,287, leaving a gross profit of £2,644 (£3,293). The net result, after payment of capital charges, was a profit of £605, as compared with £374 in 1920-21. The sales rose from 343,834 to 390,777 kWh.

Lancaster.—Purchase of Undertaking.—The electrical engineer has submitted to the Electricity Area Scheme Committee details as to capital cost of the National Projectile Factory power station if adapted to give a bulk supply to Lancaster and Morecambe, together with the cost of converting the present power station in Marton Street to a rotary substation and connecting by cable to the National Projectile Factory station. Particulars were also submitted of the estimated cost of production at the Projectile Factory station. It was resolved that the town clerk arrange for an interview with representatives of the Disposal and Liquidation Commission relative to the purchase of the National Projectile Factory station.

Leeds.—Extension of Supply.—The residents of Alwoodley, who are outside the city boundary, have applied to Leeds Corporation for a supply of electricity, and the Corporation is seeking the necessary sanction of the Electricity Commissioners.

Maidstone.—Loan.—The Town Council has applied to the Electricity Commissioners for a loan of £17,266 for a new boiler, accessories, and buildings for the electricity works.

Milnrow (near Rochdale).—Electricity Scheme.—The Urban District Council has received Parliamentary approval to an electricity supply scheme for the district. The scheme provides for a bulk supply from the Rochdale Corporation, and the demand is already sufficient to ensure against any charge on the district rates. The total cost of the scheme will be over £8,000.

New Zealand.—Hydro-electric Development.—The progress being made in the Dominion with the erection and extension of hydro-electric works was dealt with by the Hon. J. G. Coates, Minister for Public Works, who presided at the Power Board's Conference at Wellington. He stated that since the last conference the Lake Coleridge power plant has been increased from 8,000 h.p. to 16,000 h.p. capacity. Contracts have been placed for the increase of the Horahora plant from 8,400 h.p. to 14,000 h.p., and of the Waipori plant from 8,000 to 12,000 h.p. The Mangahao plant of 24,000 h.p. is well in hand, and the Monowai plant, of the Southland Power Board, is under way with a capacity in the first installation of 5,000 h.p., capable of extension up to 16,000 h.p. The New Plymouth Borough plant is being extended from 1,000 h.p. to 6,000 h.p. The first development of Waikaremoana of 1,000 h.p. will be ready for operation in a few weeks, and finally the Arapuni plant, with a capacity of 36,000 h.p., capable of extension to 140,000 h.p., has been started. By 1925 the total output of the plant installed in the Dominion will have been increased from 69,000 to 147,000 h.p.—*Reuter's Trade Service* (Melbourne).

Portsmouth.—Price Reductions.—The Town Council has decided to reduce the initial charge for electricity for lighting by ½d. per kWh, for power by ¼d. per kWh, and for street lighting by 5s. per annum on small lamps, and 20s. per annum on the larger ones.

Loans.—Application is to be made for a loan of £31,000 for the installation of a 4,000-kW turbo-alternator and two water-tube boilers, and £40,000 for services and mains extensions.

Sheringham.—Electricity Supply.—The Urban Council has under consideration a proposal to light the town with electricity, and steps have been taken to obtain a report from consulting engineers.

South Africa.—Proposed Standards.—The *South African Engineer and Electrical Review* states that the Electrical Section of the South African Branch of the British Engineering Standards Association has recommended that the following standards be adhered to in new installations:—Direct current systems: Consumers' pressure 220 and 440 V; station pressure 242 and 484 V. Alternating current (3-phase) systems: Consumers' pressure, between phase and neutral 240 V, between phases 416 V; station pressure 264 and 457 V. The specification for extra-high pressures stipulates that the delivered (declared) pressure and the station pressure shall be the same for 3,000 V supplies. Above this an increment of 10 per cent. is added to the declared pressure to give the station pressure.

King William's Town.—Owing to heavy rainfall, the Buffalo River recently came down in flood, partially submerging the municipal electric power station and causing a stoppage of the supply for several days.

Stainland (near Halifax).—Electricity Scheme.—At the District Council meeting last week a letter was received from the Yorkshire Electric Power Co. stating it was not prepared to entertain the Council's application for electric lighting, pending the Electricity Commissioners' decision on the Aire and Calder Electricity District. The Council decided to ask the company to give the matter further consideration and to arrange an interview.

Truro.—Electricity in Bulk.—The Town Council has decided to take a supply of electricity in bulk from the Cornwall Electric Power Supply Co. The price at any time is not to exceed 2½d. per kWh, and, in order to carry out the scheme, a sum of £15,000 will be necessary. It is proposed to supply electricity to consumers at 10d. per kWh for lighting and 5d. per kWh for other purposes.

Ullapool (Ross-shire). — Electricity Supply. — Electric lighting has recently been installed in the district.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—We have received the report of the Melbourne and Metropolitan Tramways Board for the year ended June 30th, 1922. Both cable and electric systems showed a profit. Some idea of the comparative extent of the two systems may be gained by regarding the capital expenditure upon each. This, at the end of the year, was:—Cable system, £2,356,580; electric system, £1,853,026. The revenue of the electric tramways totalled £600,698, and the working expenses amounted to £436,519, leaving a gross profit of £164,179. This, together with the gross profit from the cable system, and interest received, gave an available total of £460,053. After the payment of capital charges, &c., a balance of £306,217 was carried to the appropriation account. From this various payments were made, including £190,000 to renewals reserve and £98,107 to the State, and a balance of £7,792 was carried forward. A total of £239,245 has been contributed to the State consolidated revenue. The number of passengers carried was:—Cable, 151,201,763; electric, 63,546,435; total, 214,748,198. The report refers to the appointment of Mr. T. P. Strickland, M.I.E.E., as chief engineer, and discusses the electrification of the cable routes. The various systems of electrification are reviewed, and the conclusion arrived at is that the overhead trolley system is the most suitable and economical.

Birkenhead.—Track Renewals.—With a view to providing work for the unemployed, the Tramways Committee proposes to reconstruct the tramway track along Conway Street, between Claughton Road and Park Road East, at an estimated cost of £20,000.

Continental.—Spain.—A company has been formed in Ferrol to construct and operate an electric tramway between that town and Jubia.

Derby.—Year's Working.—The accounts of the municipal tramway department for the year ended March 31st last show a total income of £112,084, as compared with £120,569 in the preceding year. The working expenses amounted to £96,613, as against £105,922, leaving a gross profit of £15,471 (£14,647). Capital charges, &c., absorbed £12,240, making the net result a profit of £3,231, comparing with £2,099 in 1920-21. Against this was debited a loss of £527 upon the omnibus services, leaving £2,704 to be carried to the renewals fund, as against £1,755. The numbers of passengers carried were 1,162,686 (electric cars) and 191,944 (electric 'buses); the car-mileage was 1,162,686 and 18,963 respectively.

India.—Calcutta Tube Railways.—Mr. Dalrymple-Hay's report says that the construction of tube railways in Calcutta is possible on the hooded-shield and clay-pocket system. The proposed route from east to west is 6.6 miles in length, and the portion in tunnel will be 5.9 miles. The internal diameter of the tunnels will vary from 12 ft. 6 in. to 13 ft. 6 in., and the gauge will be 5 ft. 6 in. The estimated cost is £3,500,000. —*Reuter's Trade Service* (Bombay).

Leeds.—New Route.—The Corporation Tramways Committee contemplates extending the tramway system to Templenewsam (*via* the Selby Road), to Killingbeck (*via* the York Road), and from there into Crossgates.

Leicester.—Proposed Replacement of Tramcars.—According to the *Daily Mail*, the Chief Constable has reported in favour of the gradual replacement of tramcars by motor omnibuses to relieve traffic congestion in the city.

Linthwaite (Yorkshire).—Accident.—A heavy Bradford motor wagon skidded on the wet roadway in the early morning of December 1st, and knocked a tramway standard so far out of position that the overhead wires were broken. The driver was injured and had to be taken to the infirmary. The tramway service was delayed some time while the damaged overhead system was being repaired.

London.—Proposed Fare Reductions.—As the Highways Committee of the L.C.C. recognises that much of the reduction in working costs is due to decreased wages paid to workmen, it proposes that certain reductions shall be made, as from January 1st, 1923, in workmen's fares. The new fares will be as follows:—Not exceeding four sections, 2d. return (approx. distance 4.8 miles); exceeding four, but not exceeding eight sections, 4d. return (approx. distance 9.6 miles); exceeding eight sections, 6d. return. The committee has also decided that during those hours in which the 2d. maximum (mid-day) fare is in operation, the penny fare stage shall be three sections of approximately .6 mile each.

The London United Tramways, Ltd., are reducing the 1½d. tramway fares to 1d.

Paisley.—Sale of Tramway Undertaking.—The shareholders of the Paisley and District Tramways Co. have unanimously agreed to sell the Paisley tramway system to Glasgow Corporation for £250,000. Directors and certain officials are to be compensated for loss of office.

Salford.—Year's Working.—The report of the general manager of the Corporation tramways (Mr. G. W. Holford) for the year ended March 31st, 1922, records a gross income of £564,226, as compared with £542,747 in the preceding year. Working expenses amounted to £458,052, as against £433,950, leaving a gross profit of £106,174 (£108,797). After the payment of capital charges a net profit of £7,574 remained, a large decline from the previous year's figure—£16,812. The number of car-miles run increased from 6,019,067 to 6,085,439, but the number of passengers carried decreased from 78,142,501 to 76,207,968. All the above statistics include those of the motor-omnibus service.

West Ham.—Reduced Fares.—The Town Council has decided to reduce its tramway fares on January 1st next, when the charges will be one penny for two sections and 1½d. for three sections. Each section is approximately half a mile in length. Workmen's fares are to be at the rate of single fare for the double journey, with a minimum of 2d. return.—*Westminster Gazette.*

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—Radio Telegraph Patents.—It is understood, writes the Exchange Telegraph Co.'s Antwerp correspondent, that the Radio Corporation of America is prepared to cede its rights for the exploitation in Belgium of certain patents applying to apparatus for the reception of radio messages and to antennæ.—*Financial Times.*

Cuba.—Broadcasting.—Radio telephone broadcasting is about to be inaugurated in Cuba, says the *T. & T. Age*, and interest is thoroughly active in the matter.

Germany.—Increased Tariffs.—The commercial adviser of the Imperial Post Office has recommended that the postal, cheque, telegram, and telephone charges be increased on the average by 100 per cent. This proposal must be submitted to the Reichsrat and the competent committees of the Reichstag before coming into force.—*Reuter.*

New Zealand.—Radio Telegraphy.—The Postmaster-General, Mr. Coates, is in favour of a direct radio system giving New Zealand world communication in preference to the chain system. Two companies have been negotiating for rights, but the Government is unable to move because Great Britain has not yet decided on her action.—*The Times.*

Radio Telephony.—Broadcasting.—Since broadcasting actually began there has been a steady and growing demand for licences. A striking increase is shown in the number of experimental licences, which are granted only to those who are competent to make a useful contribution to radio research. Up to the end of last March 8,000 such licences had been issued, but by October 31st the number had increased to over 18,000, an increase of more than 10,000 in seven months.

The Fire "Risk."—The St. Pancras Estates Committee recommends "that applications from tenants of flats in the Council's dwellings to fix wireless installations be not acceded to." The committee reports that the insurance company with which the property is insured against fire considers that it would be advisable to refuse permission if the sets are being installed and fitted by amateurs, or else insist on their being inspected by a qualified engineer and on a signed report being obtained that everything is in order. The company also advises that special attention be given to fixing the aerials and to the earthing having been properly carried out. With regard to the Council's maisonnettes, where garden ground is available, and the apparatus need not be fixed on the buildings, the committee has deferred its decision pending consultation with the chief electrical engineer.—*The Times.*

A correspondent of *The Times* complains that the Corporation of the City of London has refused him permission to erect an aerial on a building which is the property of that body. The building is a large block of flats of which the roof is flat and put to many uses by the occupants of the dwelling. The view taken by the Corporation was that if one such request were granted no similar one could reasonably be refused. The erection of a forest of aerials would make it impossible to use the roof for other purposes, but it is not to be assumed that an objection would be raised to putting an aerial on a roof of one of the Corporation's buildings if the amenities of the place were not thereby impaired, subject to the approval of the fire insurance company concerned.

Radio Telegraphy.—Ships' Operators.—The Cunard Steamship Co. has decided to maintain its radio branch, so that every member of the crews shall be subject to the company's discipline. Hitherto the fifty operators in the company's fleet have been employés of the Marconi Co. The Cunard operators will wear a specially-designed uniform, and a senior operator will rank equivalent to a second officer of the navigating branch; junior operators will be graded as officers. The White Star and other lines do not intend, at present, to follow the Cunard example, but will rely on the Marconi Co. and other radio firms for their operators and installations.—*Evening News.*

Russia.—Eastern Telegraph Routes.—The Great Northern Telegraph Co. expected to open offices at Moscow and Omsk on December 1st. The Soviet Government has guaranteed the officials of the company full liberty and has allowed the company to establish special food centres. All telegrams for East Asia by the company's route will be forwarded from Omsk. At present two lines, *via* Irkutsk and Peking and Kiachta and Harbin, are working, and telegrams from London to Shanghai can now get through in two hours. There has not been very great difficulty in repairing the lines, the damage done having been less than was expected. Danish engineers have examined the whole route, accompanied by Russians, who have learned to use the apparatus. Telegram rates in Russia were not raised during the war; most of them are unchanged, but some have been reduced. The Danish company expects that there will be great telegraphic traffic to the East *via* Copenhagen as soon as the new Russian stations are opened.—*The Times.*

Sweden.—Broadcasting.—The Allgemeine Elektrische Gesellschaft, Svenska Radio Aktiebolaget, and Tidningarnas Telegrambyras Aktiebolaget have applied to the Swedish Government for a joint concession for a monopoly of broadcasting in the country. The radio companies intend, if the concession is granted, to form a special company for this purpose with a minimum share capital of kr. 1,000,000.—*Reuter.*

The Telegraph System.—Tariffs.—Mr. N. Chamberlain, Postmaster-General, answering a series of questions in the House of Commons, said that the number of inland telegrams sent in the United Kingdom (including Ireland) during the financial year 1913-14, when the rate was 6d., averaged about six millions a month. The number sent during the financial year 1921-22 at the shilling rate was about five millions a month. In view of the fact that even with a 1s. tariff the service was run at a considerable loss, he could not hold out any hope of a return to the 6d. rate in the near future.—*The Times.*

West Indies.—Cable Communication.—In order to maintain cable communication throughout the British West Indies, an agreement has been entered into between the British Government, the Dominion of Canada, the Crown Agents for the Colonies, and the West India and Panama Telegraph Co., allowing the company to increase its charges. The agreement provides for increases in the existing maximum rates of 6d. per word on "through" rates, and an increase of one-third, with a maximum of 6d., for inter-island rates. Deferred Press and Government telegrams are to be carried at half the ordinary rates. These increased rates are authorised until March 31st next, and the future rates are to be decided by circumstances.—*Financier.*

The Treasury considered various proposals to prevent the cessation of the company's system, including its purchase by the Governments concerned, but decided on the above policy.—*Morning Post.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.)

OPEN.

Abertillery.—December 15th. Electricity Department. One 2,200-V, h.p. feeder, one 200-kW and one 30-kW converting sets; h. and l.p. switchgear; static transformers and l.p. switchgear; a.c. overhead and underground distributing system. (November 24th.)

Atherton.—December 20th. Urban District Council. Two 30-kVA, single-phase transformers and one 150-kVA ditto. (December 1st.)

Australia.—Perth.—January 17th. Postmaster-General's Department. Telephone and telegraph apparatus, testing instruments, and protective apparatus.*

Newcastle, N.S.W.—December 14th. City Council. Transformers and control equipment.*

Melbourne.—January 24th. Tramways Board. 1,650 steel poles, either solid or in three sections.—*Reuter's Trade Service* (Melbourne).

Sydney.—January 31st. New South Wales Railways Department. Four 1,000-kW rotary converter sets.—*Reuter's Trade Service* (Melbourne).

Belgium.—December 16th. Direction Générale des Prisons, Service Central du Travail, 81, Rue Ducale, Brussels. Electric motors and machines required in connection with the bookbinding departments in the various Belgian prisons.

Bolton-upon-Dearne.—December 21st. Dearne District Light Railways Committee. Construction and equipment of the Dearne District Light Railways.—Rails and fishplates; points and crossings; permanent way, road widening, and bridge works; overhead line equipment; feeder cables; substation plant; rolling stock; buildings. (December 1st.)

Dublin.—December 18th. Dublin United Tramways Co. (1896) Ltd. Stores for six months. (See this issue.)

Edinburgh.—December 12th. Tramways Department. 21,500 fishplate bolts and nuts and 12,500 tie-bars. Forms from the manager.

Headington, near Oxford.—December 9th. Board of Guardians. Installation of electric lighting in the infirmaries, &c. (November 24th.)

Hull.—December 11th. City Council. Construction of 420 yd. of tramway track in Osborne Street. F. W. Bricknell, city engineer, Guildhall, Hull.

India.—January 9th. Great Indian and Peninsular Railway Co. Electrification of Bombay suburban lines: Electrical equipment of coaches, overhead equipment of permanent way, and overhead distribution lines. (November 17th.)

London.—Barking.—December 19th. County of London Electric Supply Co., Ltd. Water-tube boilers for the Barking power station. (November 24th.)

Long Eaton.—December 11th. Electricity Department. Storage battery, 3-wire booster, switchboard, and steel platform. (December 1st.)

Manchester.—January 1st, 1923. Rivers Committee. Conversion of Davyhulme sewage works, Urmston, from steam to electric drive. Secretary, Rivers Department, Town Hall, Manchester.

New Zealand.—Wellington.—January 30th. Posts and Telegraph Department. 2,000 g.i. earth-rods, 5 ft. x ½ in.*

Nuneaton.—December 20th. Electricity Department. One balancer, complete with switchboard panels and accessories. (See this issue.)

Portsmouth.—December 13th. Board of Guardians. Electrical fittings for three months. Mr. H. C. Morrell, clerk, St. Michael's Road.

South Africa.—Brandfort, O.F.S.—January 30th. Municipal Council. Water-tube steam boilers, steam engines and alternators, switchboard, boiler and engine-house auxiliaries, steel poles and overhead conductors (erected), transformers, house services and meters. Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.—*Reuter's Trade Service.*

Malmesbury.—January 26th. Municipal Council. Electric lighting plant, including two 75-kW d.c. sets, boilers, poles, battery, &c.*

Torquay.—December 18th. Electricity Committee. Two 400-kW rotary converters and one 300-kW rotary converter, complete with transformers, switchgear, and accessories. (December 1st.)

Warrington.—December 11th. Electricity and Tramways Department. Motors. (November 24th.)

December 19th. Board of Guardians. Supply of electrical goods for three months for Warrington Union. Mr. A. Bottomley, clerk to the Guardians, Bewsey Chambers, Warrington.

Wingate (Co. Durham).—December 9th. Parish Council. Electric lighting installations at Wheatley Hill Council houses and to Wingate Lane; also at Deaf Hill Council houses. Mr. W. Stoker, clerk to Wingate Parish Council, 1, Eleventh Street, Wheatley Hill, Co. Durham.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Dundee.—Quotations for cable for the Corporation Electricity Department showed that a German offer was about £150 below the lowest British offer, but the engineer pointed out that he had no knowledge as to the quality of the German cable, and the British offer of £1,204 was accepted.

Glasgow.—Corporation. Accepted:—

Electric lighting installation at the Moncur Street lodging-house (£94).—Small & Macdonald.

Hoylake and West Kirby.—Electricity Committee. Accepted subject to the sanction of the Electricity Commissioners:—

Condenser (£670).—Belliss & Morcom.
Cooling tower (£621).—Film Cooling Towers, Ltd.

London.—Shoreditch.—Lighting Committee.

One 20-ton overhead travelling crane for Whiston Street sub-station:—

Herbert Morris, Ltd. (accepted)	**£1,040**
S. H. Heywood, Ltd.	1,087
Babcock & Wilcox, Ltd.	1,285
Royce, Ltd.	1,408
Vaughan Crane Co., Ltd.	1,693

Manchester.—Tramways Committee. Accepted:—

Electric goods lift.—W. Wadsworth & Sons, Ltd.

Waterworks Committee. Accepted:—

Cable for Whitworth Street West station.—W. T. Henley's Telegraph Works Co., Ltd.

Electricity Committee. Accepted:—

Cable.—Macintosh Cable Co., Ltd.
Two sets of electric telegraphs for Barton power station.—Chadburn's (Ship) Telegraph Co., Ltd.

Housing Committee. Accepted:—

Installation of electric lighting at houses on the Fallowfield, Blackley, and Newton Heath estates.—J. V. Pyatt, of Manchester.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, December 9th. At the Grand Hotel. At 7 p.m. General meeting.

Royal Society of Arts.—Monday, December 11th. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture, "Brown Coal and Lignites," by Prof. W. A. Bone.

Junior Institution of Engineers.—Tuesday, December 12th. At the Royal United Service Institution, Whitehall, S.W. At 7.30 p.m. Presidential address, "The Utility of Theory to the Practical Man," by Capt. H. Riall Sankey, late R.E.

Friday, December 15th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Notes on Printing Machinery," by Mr. W. T. Marchant.

(North-Eastern Section).—Tuesday, December 12th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "The Heavy Oil Engine," by Mr. J. Calderwood.

Paisley Association of Engineers.—Thursday, December 12th. At 99, High Street. At 7.30 p.m. Paper on "Broadcasting," by Mr. H. Hamilton.

Illuminating Engineering Society.—Tuesday, December 12th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Recent Developments and Modern Requirements in Street Lighting," to be opened by Mr. H. T. Harrison.

National Association of Supervising Electricians.—Tuesday, December 12th. At St. Bride's Institute, E.C. At 6.45 p.m. Lecture on "The High Cost of Electrical Installations," by Mr. W. J. Revell and Mr. F. T. Alldread.

Electro-Harmonic Society.—Tuesday, December 12th. At Caxton Hall, Westminster. At 8 p.m. Smoking concert.

Greenock Association of Electrical Engineers.—Wednesday, December 13th. At 22, West Stewart Street. At 7.45 p.m. Paper on "Lamp Manufacture," by Mr. J. M. Anderson.

Liverpool Engineering Society.—Wednesday, December 13th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Water and Water Power," by Mr. D. H. Thomson.

Nottingham Society of Engineers.—Wednesday, December 13th. At the Welbeck Hotel. At 7.30 p.m. Annual dinner.

Chelmsford Engineering Society.—Thursday, December 14th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Lubrication of Internal-Combustion Engines," by Mr. A. B. Smith.

Northampton Engineering College Engineering Society.—Thursday, December 14th. At the Northampton Institute. At 5.30 p.m. Paper on "Steam Turbines," by Mr. M. L. G. Semple.

Optical Society.—Thursday, December 14th. At the Imperial College of Science, South ensington, S.W. At 7.30 p.m. Ordinary meeting.

Chemical Society.—Thursday, December 14th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture on "The Metallurgical Applications of Physical Chemistry," by Prof. C. H. Desch.

Institution of Electrical Engineers.—Thursday, December 14th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Electric Arc Welding Apparatus and Equipment," by Mr. J. Caldwell.

(Students' Section).—Sunday, December 10th. At 3 p.m. Visit to the City and South London Railway Reconstruction Works.

(Liverpool Sub-Centre).—Monday, December 11th. At the University, Liverpool. At 7 p.m. Paper on "Domestic Load Building," by Mr. W. A. Gillott.

(East-Midland Sub-Centre).—Tuesday, December 12th. At Loughborough College. At 6.45 p.m. Short papers.

(North-Western Centre).—Tuesday, December 12th. At the Engineers' Club, Manchester. At 7 p.m. Informal meeting. Discussion on "Low- and Medium-pressure Industrial Wiring," to be introduced by Mr. J. Firth.

(Scottish Centre).—Tuesday, December 12th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Possibilities of Transmission by Underground Cables at 100,000/150,000 V," by Mr. A. M. Taylor.

(Scottish Centre).—Students' Section.—Friday, December 15th. At the Royal Technical College, Glasgow. At 7.30 p.m. Magazine night.

(Dundee Sub-Centre).—Thursday, December 14th. At the University College, Dundee. At 7.30 p.m. Paper on "Automatic Protective Gear," by Mr. A. E. McColl.

(South-Midland Centre).—Wednesday, December 13th. At the University, Birmingham. At 7 p.m. Paper on "The Possibilities of Transmission by Underground Cables at 100,000 to 150,000 V," by Mr. A. M. Taylor.

Institution of Mechanical Engineers.—Friday, December 15th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "Reclamation Plant and Its Operation," by Mr. G. Lumley.

British Electrical Development Association.—Friday, December 15th. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Salesmanship Conference—Lecture on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," by Mr. W. Attwood.

Institution of Production Engineers.—Friday, December 15th. At the Engineers' Club, W. At 7.30 p.m. Paper on "The Production Engineer," by Mr. H. E. Honer.

NOTES.

Appointments Vacant.—Lecturer on the design of electrical machinery, for Faraday House Engineering College. Shift charge engineer for the Kilmarnock Corporation Electricity Supply Department. Plumber-jointer for the Hackney Corporation Electricity Department. Chief electricity accounts clerk (£240) for the Guildford Corporation. (See our advertisement pages to-day.)

Service Notes.—Major F. W. Home, Royal Marine Light Infantry, has been appointed to H.M.S. *President*, London, for service with the Wireless Telegraphy Board at the Admiralty. Major Home was commissioned in the Royal Marines in 1901, reached his present rank in June, 1917, and having specialised in wireless telegraphy, has been associated with that branch of the service for some time. He will join the Board on New Year's Day. Captain A. J. Mellor, Royal Marine Light Infantry, has been appointed to the Cleethorpes radio telegraph station from the date of taking over. This officer got his commission in the Royal Marines in 1902, and was promoted captain in September, 1914. He held the temporary rank of major during part of the Great War, and was a staff officer for some time. Major W. D. Merrett, T.D., A.M.I.E.E., late of the London Electrical Engineers, has been posted in the same rank to the 11th A.A. Battalion, Royal Engineers, Territorial Army. Capt. W. H. Rodgers, from the London Electrical Engineers has been appointed a major in the 10th A.A. Battalion, Royal Engineers, Territorial Army. He was a captain in the Royal Engineers during part of the Great War.

Lectures.—"How Electricity Helps the Farmer."—On November 25th a crowded and appreciative meeting of the Bedford Park Natural History and Gardening Society attended a lantern lecture given on the above subject by Mr. H. A. Carney (who is associated with the work of Mr. R. Borlase Matthews, the apostle of electro-farming in this country). A comprehensive series of slides (many from photographs taken at Greater Felcourt) was shown, and according to data given by the lecturer the consumption of electricity is relatively trifling, the energy which will light a forty-watt lamp for 25 hours being sufficient, for instance, to chaff half a ton of hay, or cut up six tons of swedes, or milk 52 cows, or churn and make 165 lb. of butter; the work in all cases being accomplished without physical exertion and in a fraction of the time possible by other methods.

Electro-culture or the electrical stimulation of plant growth was referred to as a proven possibility and one likely to be of all-round benefit to the farmer, who can rely upon a minimum increase of 10 per cent. in his crop yields from its application. Instances of much higher yields were mentioned, up to 50 per cent. increase (for instance for wheat, oats, and potatoes), the annual financial gains varying (at pre-war prices) from £3 10s. to £15 per acre. It appears, however, that the necessary equipment has not yet been developed on a commercial scale for really practical work on farm. The success which attended electric haymaking has since been repeated on a large farm whose corn crop, extending to several hundred acres, was in danger of rotting on the fields. By installing suitable equipment the crop was saved, and is now being thrashed. Even in fruit growing it seems that electricity may be useful, for a reference was made to some experiments that are being carried out in New Zealand, where electric lamps are hung in the fruit trees. By increasing the producing capacity of farms and of the labour employed, the extended use of electricity in agriculture will eliminate the more monotonous and the heavier part of the work, and the status of the farm worker will be raised, his standard of living improved, and his wages increased because of his increased productive capacity.

"Safety First."—On November 27th, members of the Circle of Scientific, Technical and Trade Journalists, and representatives of the technical Press, paid a visit to the extensive repair works of the London General Omnibus Co., Ltd., at Chiswick, at which a fleet of 3,000 motor-buses is overhauled, with the result that the breakdowns have been reduced to a minimum.

Following the inspection of the works an address on the "Safety First" movement in England was given by Mr. H. E. Blain, C.B.E. The address dealt both with industrial safety methods and with the steps being taken by the London Safety First Council to diminish accidents in the streets of London, and thus followed very appropriately after the inspection of the repair shops. Mr. Blain illustrated his remarks by lantern slides of a great variety of posters which have been used in propaganda in schools, &c., and reference was made to the useful work of the Drivers' Educational Committee. It was stated that, in spite of the great increase in vehicular traffic, the number of accidents to persons or property in the Metropolitan Police District has been reduced from 55,700 in 1914 to 45,700 in 1920.

The work of the British Industrial Safety First Association is proving equally useful in factories. In 1920 a sum of £6,000,000 was paid in workmen's compensation in connection with 3,500 deaths, so that there is ample scope for the movement. It was stated that many members of the Association have been most successful in reducing accidents in their works.

The Classification of Engineers.—In 1920 the Council of the Engineering Institute of Canada appointed a committee to consider the grading of members of the Institute, and recommend rates of annual remuneration. The committee's report was published in the November issue of the *Engineering Journal*, the Institute's organ. With regard to chief engineers it was considered that such positions were outside the committee's scope, and a commencement was therefore made at the grade of "assistant chief engineer," whose duties were defined as "to act in administrative charge of a technical organisation, or of a main division thereof." The necessary qualifications are set out, and an attempt is made to specify equivalent positions among which are those of city engineer, and superintending engineer of a province. Grade II is defined simply as "engineer," and the positions corresponding to this grade include those of district engineer and designing engineer. The subsequent grades are: III, Senior Assistant Engineer; IV, Assistant Engineer (chief draughtsman, estimating engineer, &c.); V, Junior Assistant Engineer (inspecting engineer, &c.); VI, Junior (senior draughtsman, inspector, &c.); VII, Senior Aid (draughtsman &c.); VIII, Junior Aid (tracer, chainman, rodman, &c.). In computing a basis for salaries years of service and the possession of a degree are taken into consideration. Minima and maxima are given in most cases, but in Grades I and II the maximum is given as "no limit." The minimum for Grade I is $7,200, the minimum and maximum for Grade VIII are $600 and $1,200.

Transatlantic Radio Communication Tests.—The main object of the forthcoming transatlantic communication tests between American, Canadian, and European radio amateurs is not only to pick up signals from the other side of the Atlantic, as was done last year, but also (if possible) to establish communication in both directions across the ocean solely between amateur stations when using amateur wavelengths. Arrangements have been made for the use of specially equipped transmitting stations in this country during the tests. Several French stations will also be transmitting. The dates of the transmission tests from this side will follow the transmissions from the United States. As in last year's tests, the transmission from America and Canada will be on the usual American amateur wavelengths in the neighbourhood of 200 metres, and also on the special wavelengths in the neighbourhood of 365 metres, which are licensed to some of their stations. Transmission will take place during five hours on each night, the stations taking part being allotted a different portion of the five-hours' period on successive nights. The wavelength of transmission at any given time will, therefore, be different on successive nights. With regard to the American Radio Relay League's preliminary tests to determine the best transmitters, several American stations have been heard in this country, so that the main tests this month should be productive of better results than were obtained last year. During last year's tests a broadcast report was made each morning by Carnarvon radio station, which report was repeated slowly by New Brunswick station for the benefit of the American amateurs, giving the results of the receptions made by the representative of the American Radio Relay League, who was listening-in in Scotland. Through the kindness of the Marconi Co., and of the Radio Corporation of America, it will again be possible to broadcast such daily reports from Carnarvon.

The French committee which is arranging the part to be taken by the French amateurs, both in listening and in transmitting, has also arranged for daily transmissions to be made from Sainte Assise station (near Paris), which reports will be repeated by Marion Station in the United States, the times being 0700 G.M.T. for Carnarvon, and 0710 G.M.T. for Sainte Assise.—*Wireless World.*

The daily Press announces that at Croydon, during the night of November 26-27th, music transmitted in the U.S.A. was heard, together with the call letters W.J.Z., on a wave length of 325 metres (Newark, New Jersey). The music was heard for over an hour, also on fewer than nine American amateur stations were heard calling each other, the most distant one heard being that at Chicago. On the same night music from America was heard at Holyhead, and members of the Manchester Wireless Society heard 23 American amateur stations communicating among themselves, one being in California. The society is attempting to communicate with the U.S.A. At Highgate, on October 15th, music and words were picked up from America on a special two-valve set, by means of which more than a dozen American amateur stations have been heard. At Liverpool, during the night of December 1-2nd the New Jersey broadcasting station was heard.

New Zealand Electrical Regulations.—Mr. Lawrence Birks, B.Sc., M.I.E.E., &c., Chief Electrical Engineer, New Zealand Public Works Department, has sent us a copy of the amended regulations concerning electricity supply in the Dominion. The greater part of the regulations govern the construction and working of overhead lines. One of the principal alterations is the change in the definition of high pressure from 3,300 to 6,600 V (between phases). A new feature is a scale of licence fees for electric lines based on the carrying capacity. The clause dealing with lines within towns and city areas has been recast to permit the use of bare wires without permit provided certain conditions are complied with. Additions are made to the section covering the precautions to be observed to prevent interference with telegraph and telephone lines. Another new clause prescribes conditions where e.h.p., h.p., and l.p. lines are carried on the same poles. In the section dealing with inspection a scale of fees is given. Two new clauses provide for the removal or alteration of any line which is considered dangerous, at the expense of the owner of the line.

Removal of Boiler Scale by CO_2.—According to *Indian Engineering*, Messrs. R. J. Cross and R. Irvin, of the Mellon Institute of Industrial Research, have found that boiler scale can be removed by the aid of a solution of carbon dioxide in water. In an experiment pieces of boiler scale were put into a bottle and just covered with water. Carbon dioxide was then applied at a pressure of 70 lb. per sq. in. After four or five days the scale started to disintegrate, and this action continued until a week had elapsed.

Similar treatment was then given to the tubes of two horizontal return boilers with a scale accumulation of years, which withstood all attempts at removal by mechanical means. After the discharging of the CO_2 through the tubes the boilers were allowed to stand for eight days. At the end of this time it was found that the scale could be removed by simply applying a high-pressure water hose. In this way practically the whole of the scale was eliminated and the exposed surface of the tubes had the appearance usually possessed by new tubes.

Radio Reception on Moving Vehicles.—The Canadian National Railways are experimenting with radio receiving apparatus on their Toronto-Ottawa trains, and have met with an encouraging degree of success, says the *Electrical News*. The difficulties are greater than appears on the surface. It is necessary to put the antenna a considerable distance from any object, especially a conductor, within fifteen or eighteen inches from the steel of the car. No matter how tightly the aerial is drawn, it will sway and move with respect to the ground as the train travels. This causes a constant change in capacity between the antenna and the ground. The lead-in wire cannot be removed more than one or two inches from the steel car, thus bringing the antenna in close proximity to the ground. The ground wire is soldered firmly to the trucks of the coach, which makes a fairly good ground while the train is standing still, but as soon as the train is started an oil film forms between the journal and the axle of the car, causing a high resistance between the trucks and the ground. Mechanical motion in the set causes very audible noises in the receivers or loud speaker, and it will be appreciated what will happen on a moving train when the instruments are continually in mechanical vibration. Then there are the deafening train noises to overcome, as the output must be loud enough to be heard above all other competing noises. Apparently an inside aerial is not successful.

Conditions in a rapidly-moving train change so rapidly that perfect tuning is difficult. When travelling through heavily-wooded country the signals become very faint, and strong again when cleared land is reached. When near a body of water, the signal strength increases considerably, but when going over a high bridge it dies down. It is not affected to any extent by going through a cut with high walls of rock or clay on either side of the train. Sometimes, as the train goes round a curve, the signal strength becomes fainter and sometimes it increases. This may be due to the position of the antenna relative to the broadcasting station.

One other thing which affects reception is the proximity to power lines, which run along railway lines or across them. When near a power line, interfering sounds are heard distinctly in the loud speaker, sometimes so as to drown the radio signals. Telephone or telegraph lines have little or no effect. Experiments have been carried far enough to show that there are great possibilities in radio railroad work both in receiving and broadcasting, first as a source of entertainment for passengers by means of concerts, then for commercial purposes in sending and receiving communications and for train dispatching. A specially-constructed railway set will be necessary to overcome the peculiarities of train operation before dependability is reached. The secret of success may be in frequency amplification, upon which much experimental work is now in progress. When a point of reasonable perfection has been reached radio apparatus will be added as a part of national service on important trains. The reception of radio signals while riding in a motor-car has been achieved on various occasions. The Marconi Co. recently made some tests of such a nature between London and Chelmsford, and a car equipped with radio apparatus and a frame aerial took part in the Lord Mayor's show.

Electrical Betting.—One manifestation of the "electrical idea," which may not be considered favourably by everybody in the industry, was recently described by the *Times of Ceylon*. This takes the form of an electrically-operated "totalisator," installed on the Havelock Racecourse, Colombo, for registering and paying out bets. The integrity of the apparatus is said to be irreproachable.

Educational.—Northampton Polytechnic Institute.—On Friday evening last Dr. S. Z. de Ferranti distributed the prizes and certificates for the past year. There was the usual conversazione, which was continued on Saturday evening.

A Large American Electric-Vehicle Order.—We are informed by Messrs. Electromobile, Ltd., of Otley, Yorks., that the Commercial Truck Co., their associated firm in the United States, has just been awarded one of the largest orders for electric vehicles that has ever been given out. This order has been placed by the Wagner Pastry Co., of Newark, N.J., and is for 177 standard one-ton vans fitted with nickel-iron batteries of the Edison type. These vans will supersede the petrol and horse vans required to deliver nearly 40,000 pies per day, the delivery of which on time is somewhat of a problem, and the Wagner routes cover a distance of 3,500 miles. About 15 months ago the Wagner Pastry Co. decided to experiment with electric trucks. It ordered six C-Ts and several of other makes, which it placed on all of its routes in turn. The results of the tests proved that electric trucks were far superior to any other type of equipment. This was definitely decided within a short time. To determine, however, the particular type of electric truck that would prove most satisfactory, the tests were continued for 15 months. The trucks were used through a winter, careful records being kept of every item of the cost. In these severe tests the C-Ts proved to be clean and odourless—a decided advantage for bakery delivery—they covered the routes regularly without hold-ups due to weather conditions; repair troubles were negligible, and costs were greatly reduced. The "C-T" truck is the counterpart of those manufactured in this country by Messrs. Electromobile, Ltd.

Standardisation of Electrical Equipment for Motor Vehicles.—At the last meeting of the Accessories and Components Committee of the Society of Motor Manufacturers and Traders steps were taken to form a technical sub-committee to act in connection with the standardisation of dynamos, starting motors, and switches for use on motor vehicles.

The Channel Tunnel.—In an interesting letter to *The Times*, Mr. Robert Donald advocates the construction of the Channel Tunnel as one means of providing employment. He points out that the military objections to the tunnel have practically disappeared, and that its economic and commercial advantages are admitted, whilst it would find work for a large number of men for four or five years.

The Society of Technical Engineers.—Whilst going to press we have received the following letter:—

Your very anonymous contributor, "One of Them," was rather unlucky in the timing of his attack on the S.T.E. He had only to turn to another page of your issue of December 1st to see that his case against the Society was not so complete as he had seemed to imagine, for while he assumed in his letter that the S.T.E. "is apparently moribund," "is a wash out," "appears to have made little or no headway," "is unknown to a very large number of potential members," &c., the account which you publish in the same issue of the successful launching of an unemployment scheme by the Society for its members tells a somewhat different story. The next time he wants to judge us "by the paucity of Press references" he ought to select an issue of your journal which does not happen to contain at the same time a tribute to the work of the organisation he wishes to assail, or an account of its useful activities.

Your contributor is, of course, free to do any propaganda work he wishes for the E.P.E.A., but it is not usual to do this by attacking a kindred organisation that has a much larger and more difficult work to attempt than has the E.P.E.A., which confines its operations in the main to protecting the interests of a strictly limited and specialised class.

NORMAN WYLD,
Director, Society of Technical Engineers.

London, *December 5th*, 1922.

From New Zealand to Canada.—A printer's error occurred toward the end of our leaderette bearing this title in our last issue. After the page had gone to press the word "appointment" was inadvertently substituted for "question" in the last line but two.

The London Branch of the E.C.A.—The Electrical Contractors' Association is finding the London branch growing rather beyond control, owing to the increase of membership. It is proposed, therefore, to organise a number of sub-branches in the suburban districts. The first of these is to be at Ealing, to form a centre where Ealing, Acton and district members can meet. It is hoped that the organisation of other similar sub-branches will rapidly follow.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—STREET LIGHTING.—Members of the Institution have been invited to attend a meeting of the Illuminating Engineering Society at the Royal Society of Arts on December 12th, when a paper on the subject of street lighting will be read by Mr. H. T. Harrison.

NORTH-EASTERN CENTRE.—*Students' Section.*—On December 1st the Centre held a joint meeting with the North-East Coast Institution of Engineers and Shipbuilders and the Mining Institution at Newcastle, when Mr. W. Owen lectured on "Some Observations on Distortion in Wireless Telephony." Ninety-three members and visitors were present to hear a very interesting lecture, and also some music which Mr. Owen received on the apparatus he brought with him, broadcast by the local station.

On December 2nd the same Institutions paid a visit to the Heaton Works of Messrs. C. A. Parsons & Co. About a hundred and fifty members and visitors spent a very interesting and enjoyable afternoon.

At the next meeting to be held on December 15th Mr. J. Piquet (Student) will read his paper on "Automatic Control Equipment Used in d.c. Traction" at the Armstrong College at 7.15 p.m.

Junior Institution of Engineers.—The Institution wishes to make known to engineering employers the facilities afforded by its Engineers' Register to assist employers in obtaining the services of men, technically and practically trained in all branches of engineering. The long-continued depression in the engineering world has compelled a number of members to seek the aid of the Register in finding fresh appointments. At present it contains particulars of men of all ages and degrees of experience who are open to accept positions; therefore the Council is anxious to broaden in every way the activities of the Register and thus jointly assist the members and also possible employers. No charge of any kind is made. Many employers have found the Register of great assistance to them, as only those men whose experience qualifies them for a position are put forward. All inquiries should be directed to the Secretary of the Institution at 39, Victoria Street, S.W.1.

Royal Institution.—At a general meeting of the members on December 4th Sir Arthur Keith was elected secretary in succession to the late Colonel E. H. Grove-Hills.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

We read in a Bradford paper that MR. THOMAS ROLES, City Electrical Engineer, to whose breakdown we referred some weeks ago, is progressing favourably at Brighton, though, as might be expected, he feels very keenly the enforced absence from work.

Shoreditch Borough Council Lighting Committee has elected ALDERMAN P. KELLEHER as chairman, and COUNCILLOR W. D. ELLIS as vice-chairman, for the ensuing year.

ALD. BOWES has been elected chairman of the Manchester Corporation Tramways Committee and ALD. CHAPMAN deputy chairman, and the Electricity Committee has elected ALD. DAGNALL chairman and ALD. WALKER deputy chairman, for the ensuing municipal year.

We read with regret a Paris Press dispatch to the effect that DR. VAILLANT, an X-ray specialist at the Lariboisiere Hospital, one of the many doctors who have fallen a victim of X-rays, has just had to have his right arm amputated in order to save his life. Some time ago he lost his left arm in similar circumstances.

We learn that MR. A. E. MCCLOSKEY has been called to the Bar after having completed thirty years' service on the engineering staff of the G.P.O., London. During this period his services have been successively "loaned" by the Postmaster-General to the Midland (N.C.C.) Railway; the Bombay, Baroda and Central India Railway; and the Ceylon Government Railways. He was also appointed State Engineer by the Commonwealth Government of Australia. During the war he held the rank of captain in the Ceylon Engineers, and was mentioned in despatches. Following a railway disaster at Ghaziabad, the Government of India arranged for Mr. McCloskey to deliver, at a conference of general managers, a lecture on the dangers common to all existing types of single-line block systems. In an official minute the railway board expressed the opinion that the improvements suggested by Mr. McCloskey would provide "real protection to the traffic." Mr. McCloskey was in charge of the electrical train signalling on the occasion of the Delhi Durbar, and he is at present on a year's special leave studying the causes of the recent disaster at Rangoon, in which 150 persons lost their lives. In our issue of September 8th last he drew attention to a startling recurrence of accidents due to exactly similar causes, indicating the need for establishing a central "Safety Commission," to which suggestions for the improvement of railway signalling apparatus could be submitted for examination and development.

MR. W. S. SAWTELL, who had been appointed to take charge of the Carolina Port Generating Station, Dundee, has accepted

an appointment as chief engineer in the South of Scotland. In order to fill the vacancy, the Corporation proposes to raise the status of Mr. Charles Lamb and Mr. R. L. Reid, the salary of the former to be raised by £54, making it £600.

We are informed that Mr. Carl G. Schluederberg, assistant to the managers of the Supply and Merchandising Departments of the Westinghouse Electric and Manufacturing Co., and special representative of that company in foreign countries, left recently for a four months' trip in the Orient to study business conditions there. Mr. Schluederberg will visit Japan, the Philippines, and China, to make a sales survey, investigating especially the possibilities of expansion of the market for household appliances.

Mr. David Jones, who has been on the electrical staff of the Powell Duffryn Coal Co., has accepted an appointment in India, and he has been presented by the electrical staff of the company with a gold watch and a silver cigarette case.

On the evening of November 24th a gathering was held in the canteen of the Falkirk Iron Works to mark the completion by two more of the Falkirk Iron Co.'s employés of fifty years' service with the firm.—Mr. William Anderson, of the B.B. fitting department, and Mr. Abram Henderson, of the stores department. Following their usual practice, the Falkirk Iron Co., Ltd., presented the two guests of the evening with gold watches, the presentation being made by Captain H. J. Kennard, managing director. The addition of Mr. Anderson and Mr. Henderson to the "Order of the Golden Timepiece"—as the holders of the honour have been termed—brings the number up to 32, and of these 30 are still in active service with the firm. After the presentation a social evening was spent.

The Rt. Hon. F. G. Kellaway, P.C., has been appointed a director of Marconi's Wireless Telegraph Co., Ltd.

Mr. George T. Redgment, following a breakdown in health in December last, has by mutual consent resigned his seat on the board of Mann, Egerton & Co., Ltd., and also his position as manager of their electrical department. Mr. Redgment has opened new offices at 69, London Street, Norwich, where he will practise as a consulting electrical and mechanical engineer.

Obituary.—Mr. H. Woodville Miller.—We deeply regret to learn of the death of Mr. H. Woodville Miller, M.I.C.E., M.I.E.E. He passed away on Monday after a long and painful illness. Mr. Miller was a prominent man in the electricity supply industry, and possessing a spirit of enterprise, he was advanced enough in receptivity and application of technical ideas to adopt at his station at Kensington the construction of boiler furnace to secure complete combustion which was suggested in the Electrical Review by our late contributor and friend, W. H. Booth. Mr. Miller, who was general manager and chief engineer to the Kensington and Knightsbridge Electric Lighting Co., Ltd., and a member of the Kensington & Notting Hill Electric Lighting Committee, was also a director of the London Electricity Joint Committee (1920), Ltd. He had also been a member of the Council of the Institution of Electrical Engineers. The final rites were performed at Golders Green Crematorium yesterday (Thursday) morning.

Mr. Miller was one of the pioneers of electric light and power distribution in London. He was selected, in 1886, from among the Chelmsford pupils, to assist in working out in London the system of electric light distribution which had just then been brought to completion by Cromptons, in Vienna. Throughout his life-time Mr. Miller was connected with this undertaking, and he was responsible for the design, carrying out, and the successful working, of the two companies which supply the Kensington end of London. In 1899, when it was seen that stations centrally placed in populous districts could not be extended to meet the growing demand, Mr. Miller designed and carried out the power station at Wood Lane for the supply of the Kensington & Knightsbridge Co. and the Notting Hill Co. He succeeded Col. Crompton as engineer-in-chief to the Kensington Co., and eventually became engineer and managing director of that company, and continued in this position up to the time of his death. His is a typical case of how much can be done by quiet unassuming work, gradually developing the lighting and power system to meet the requirements of the West End of London, and throughout with the utmost care for the interest of his shareholders by well-thought-out capital expenditure. He collaborated with Col. Crompton in the development of large accumulator stations as the best means of securing continuity of supply. His station placed underneath the Albert Hall is a good example of an accumulator station of its kind, and has been copied with advantage, not only in the United Kingdom, but in other parts of the world. He also worked out the system of bare copper underground mains which was, at the time of its introduction 35 years ago, considered a notable departure, and which has, to a great extent, vindicated its claims to durability, low cost of upkeep, and small interference with the surface of the streets. Mr. Miller said, and with justice, that he was proud of having in his charge an electric lighting system which could boast of being free from interruptions or extinctions for periods of 20 years at a time. He was responsible for the introduction of many improvements in steam raising apparatus, notably automatic stokers, as well as Halpin's thermal storage, and many other refinements in central station practice which have done much to reduce generating costs. Those who knew him best remember him as the quietest and, at the same time, most persistent of men, while those who met him at boards or consultations can bear witness to his clear-headed views on the correct relations of capital expenditure to the requirements of any district which had to be supplied with light and power. His engineering designs were always economically thought out, and with a close regard to low capital expenditure. He had a large circle of friends, all of whom sympathised with him in the long and painful illness which ended on Monday last. His place will not be easily filled.

Mr. W. Wilson.—In the sudden death of Mr. William Wilson, The India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., have lost another of their old and faithful servants. Mr. Wilson was engaged in the cashier's department at Silvertown during the whole length of his 56 years' service with the company, and was 71 years of age. His end, which is attributed to valvular disease of the heart, was extremely tragic, having occurred on his way to business on November 24th.

Mr. George Richard Webb.—We regret to record the death, which occurred on November 30th, at a nursing home in London, after a short illness, of Mr. George Richard Webb, eldest son of the late Francis Hughes Webb. Mr. Webb, who was an O.B.E., and a member of the Institution of Electrical Engineers, was chief stores superintendent to the Great Indian Peninsula Railway Co. at Bombay.

Will.—The late Mr. Fernand Espir left £26,468.

NEW COMPANIES REGISTERED.

Southern Radio Supplies, Ltd. (186,106).—Private company. Registered November 30th. Capital, £300 in £1 shares. To carry on the business of manufacturers of and dealers in instruments, apparatus, accessories and all materials, &c., for use in connection with radio or wireless telegraphy and telephony, &c. The permanent directors are: O. H. Relly, 29, Ocklynge Road, Eastbourne; L. Moorton, 29, Longstone Road, Eastbourne; J. H. D. Grant, no address given; E. Moorton, no address given. Qualification: £30. Registered office: 26, Junction Road, Eastbourne, Sussex.

Wilkinson's (Liverpool), Ltd. (186,100).—Private company. Registered November 30th. Capital, £2,000 in £1 shares. To acquire from A. Wilkinson the benefit of certain existing inventions relating to a new or improved device for locking electric lamp globes in their holders or sockets. The first directors are: J. Brown, The Dell, Green Lane, Wallasey; J. Davies, "Harlech," Kingsway, Waterloo, Liverpool; E. Edwards, 4, Tilson Road, Wallasey; R. F. Heighley, 66, Grove Road, Wallasey; W. H. Jones, 41, Lyndhurst Road, Wallasey; J. Taylor, 62, St. George's Road, Wallasey; A. Wilkinson, 42, St. Nicholas Road, Wallasey. Secretary: J. Taylor. Registered office: 17a, South Castle Street, Liverpool.

Aspden Flywheel Dynamotor Syndicate, Ltd. (185,950).—Private company. Registered November 24th. Capital, £5,000 in 4,500 cumulative participating preference shares of £1 each and 10,000 ordinary shares of 1s. each. To carry on the business of machinery, tool and plant merchants and agents, electrical and mechanical engineers, founders, manufacturers of and dealers in engines, motor cars and cycles, motor signal devices and component parts and fittings thereof, &c. The subscribers (each with one preference share) are: W. G. Hollister, 61a, Minories, E.C.3, clerk; Miss G. C. Cadogan, 39, Wakehurst Road, Wandsworth Common, S.W.11. The permanent directors are: R. L. Aspden, R. E. Aspden, T. B. Heath, J. C. Molson, M.D., and A. E. Showell. Qualification: £1. Solicitor: K. E. Bartlett, 11-12, Fenchurch Street, E.C.

K. H. E. Ignition Co., Ltd. (185,873).—Private company. Registered November 21st. Capital, £1,000 in £1 shares. To adopt an agreement with G. A. Edwards for the acquisition of his patent, known as the "K.H.E. Synchronised Ignition," in consideration of which 250 ordinary shares (fully paid up) shall be allotted to him, and to carry on the business of manufacturing electrical engineers, electricians, repairers and manufacturers of, and dealers in, engines, motor cars, carriages, ships, boats, aeroplanes, airships, and all other kinds of vehicles, &c. Share No. 1 shall be allotted to G. A. Edwards, and whilst held by him shall be called the Life Governor's Share. The subscribers (each with one share) are:—G. A. Edwards, 32, Oxford Street, Liverpool, engineer; A. Whittingham Jones, 41, Castle Street, Liverpool, associated accountant. G. A. Edwards is the first director. Registered office: Croxteth Works, 63a, Aspen Grove, Liverpool.

Wark and District Electric Lighting Co., Ltd. (186,144).—Registered December 1st. Capital, £1,500 in £1 shares. To acquire a sublease of a certain piece of land at Wark, Northumberland, and to erect thereon a generating station for the purpose of supplying the village of Wark and district with electric light and power. The first directors are:—A. H. Ridley, Park End, Wark-on-Tyne; T. Taylor, Chipchase Castle, Wark-on-Tyne; A. Chapman, Horraby, Wark-on-Tyne; S. S. Haggie, Lee Hall, Wark-on-Tyne; A. Andrews, Woodlands, Riding Mill; T. Reed, The Nook, Wark-on-Tyne; J. Storey, Harlow, Park Avenue, Hexham; T. Rowell, Bridge End House, Wark-on-Tyne; T. Civil, Wark-on-Tyne; Mary Charlton, Black Bull Inn, Wark-on-Tyne; Mary Bell, Hexham House, Wark-on-Tyne; A. Charlton, Battlesteads, Wark-on-Tyne. Qualification, £50.

British Radio Manufacturers and Traders' Association (186,058).—Registered on November 29th as a company limited by guarantee. The objects are: To promote and protect in the United Kingdom and abroad the various trades concerned in the supply of materials for use by suppliers of electricity, manufacturers of wireless instruments and component parts, traders in wireless parts or materials, persons and companies engaged in the wireless industries or in any branch or section thereof (collectively called "traders"), &c. The subscribers are:—E. Merriman, 73, Elliscombe Road, Charlton, S.E. 7, joint managing director, Pettigrew & Merriman, Ltd.; B. G. Calver, 52, Linver Road, Hurlingham, S.W. 6, manager, Whale Wireless Co.; J. E. Sutton, 18, Melford Road, East Dulwich, S.E. 22, wireless engineer; E. E. Rosen, 158, City Road, E.C.1, wireless engineer; H. G. Walker, A.M.I.R.E., Park Lodge, Brentford; C. Holt, 10, Fitzroy Square, W.1, wireless engineer; A. W. Knight, 26, Stanbury Road, S.E. 15, wireless engineer. The management is vested in a council, upon which no persons had consented to act to November 28th. None but trade members may be councillors. Secretary: C. Latham. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C. 2. No notice of situation of registered office was filed at time of incorporation.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marconi's Wireless Telegraph Co., Ltd.—A trust deed dated November 17th, 1922, has been registered to secure £1,500,000 debenture stock (with liberty to increase the amount at any time after March 31st, 1923, to £3,000,000). Property charged: The company's undertaking and property, including uncalled capital (if any); no other security shall be created which shall rank in priority to or *pari passu* with this security without the sanction of the stockholders. Trustees: Law Debenture Corporation, Ltd.

General Electric Co., Ltd.—Satisfaction to the extent of £35,000 on November 17th, 1922, of debenture stock dated July 22nd, 1921, securing £3,500,000.

National Signs, Ltd.—Mortgage dated November 20th, 1922, to secure £8,000 charged on certain land and premises in Hendon. Holders: D. A. C. Cruden, "The Willows," Market Harboro; and S. Hastings, 43, Devonshire Street, W.

London Magneto Repairing and Winding Co., Ltd.—Debenture dated November 24th, 1922, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. C. R. M. Clark, 68, Radnor Road, Harrow-on-the-Hill.

Varley Magnet Co., Ltd.—Satisfaction in full on November 1st, 1922, of debentures dated June 31st and June 24th, 1913, securing £2,500.

Oliver Pell Electric and Manufacturing Co., Ltd.—Satisfaction in full on February 17th, 1921, of debentures dated May 30th, 1907, securing £15,000. (Notice filed November 24th, 1922.)

Willesden Electric, Ltd.—Mortgage debenture dated November 16th, 1922, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. E. Childs, 72, Lancaster Road, North Kensington.

Pynex Manufacturing Co., Ltd.—Particulars filed of £400 debentures authorised November 23rd, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; the whole amount being now issued.

CITY NOTES.

India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd.

The ordinary meeting was held on November 30th at the offices, 106, Cannon Street, E.C., Mr. C. H. Gray, chairman and managing director, presiding. In proposing the adoption of the report the chairman said that it was a matter of extreme regret to the directors that they had again to report a net loss. That loss was due mainly to two causes, first, the necessity to further depreciate the stock values at home. Persan, and foreign branches, in which respect the accounts were affected by a sum approximating £65,000; secondly, the conditions surrounding the tire section of the business, brought about by intense foreign competition. Comparing the accounts with those of a year ago, when the trading loss was £149,640, they were able to show a gross profit of £166,490. That was a decided improvement, even though the net result revealed a loss of £94,406. The reserve fund now stood at £140,721, having been reduced by the transfer of £75,000 to the profit and loss account to cover the loss on trading. Their liabilities to bank and other creditors were less this year than last by £20,094, whilst on the assets side trade debtors and estimated amount of claim for refund of excess profits duty were £32,000 greater. With regard to tax matters, here and in France, in both cases no settlement had yet been arrived at. The cash and bills in hand stood at £84,276, as against £65,786 last year, showing an increase of £18,500. Stock in trade, including expenditure on work in progress, was less by £46,550 than the figure in last year's balance sheet. Regarding the cash, stock, debts, &c., at Persan and branches, there was a reduction of £136,643 in the figure at which these assets stood last year. The depreciation of stock values amounted to £65,000, and was brought about by the falling markets and the keen competition to obtain business. In buying their raw material they had found it very difficult to follow the fluctuations in price between the American and Egyptian varieties of cottons, which seemed to vary irrespective of their technical value. Their policy, therefore, during the past year had been to go slowly in this connection until the market settled itself into some degree of steadiness, but even with this precaution they had had to write down their raw material to the lower market value at the time of stock taking. In dealing with the second cause of the year's loss he briefly reviewed the varying phases of the tire business at Silvertown, which had culminated in the present situation. About 1902 they experimented on and produced a motor tire which was known as the Palmer cord tire. It was expensive to make, but from the point of view of efficiency it was ahead of any tire at that date. Their competitors, who were making a canvas tire (as distinct from a cord), in course of time improved in the manufacture of their product, so that in 1914 their product was relatively more efficient, although still not equal to the efficiency of the Palmer cord tire. The Palmer cord tire, however, did not fulfil the condition of low price, and therefore the works set about designing a new type of tire (which was now known as the "Flexicord"), which would be at least as efficient and cheap to produce as any competitive tire. After exhaustive experiments they produced the type of tire they were seeking in the size which would be suitable for Ford cars and vans, with the result that they were at that time in possession of the expensive Palmer cord tire on the one hand, and a cheap and efficient tire on the other (the latter, however, only in one size). The tire business was a very big one, even in these times, and they wished to get their fair share of it; they thought they would be able to do so with their new tire, but they must have the necessary assortment of sizes to meet the market requirements. In turning to the general production at Silvertown, the total sales showed only a slight increase over the sales during the eleven months ended August 31st, 1921, the figures being £1,061,736, as against £1,031,130, but analysis of those sales showed a very considerable reduction in the re-sale of bought-in goods, and an increase in the sale of Silvertown manufactures from £902,917, in 1921, to £1,009,980 in 1922. Although considerable reductions had been made in the expenditure on repairs and upkeep, on the supply of steam and power, and on administrative and non-manufacturing salaries and wages, the burden of these on-cost charges was still too much for the output of the year to carry if the selling prices at present obtainable were to yield a satisfactory profit. The market value of the stocks was again lower at August, 1922, than at August, 1921, with the result that values had to be written down in the stock sheets. They were affected by the engineers' lock-out, which commenced in April last, and continued for about three months. That caused the closing of their instrument shop for this period, and delayed the manufacture of tools and appliances required for the various departments of the works, but they were able to keep a sufficient number of non-union men to carry on the repairs and maintenance of machinery and the supply of engineering material required for customers' orders. The indirect effect on their business due to the failure of demand from engineering and other firms for their products was undoubtedly serious. They had been entirely free from any disputes with their workpeople in the rubber works. With regard to the hourly output of workers, it was difficult to get accurate comparisons, owing to the variety of goods manufactured, and the changes in rates of pay made during the year. It was thought, however, that the improvement in the output of piece workers had been maintained, and that there had been an improvement in the output of time-workers. During the past year they had done a certain amount of submarine cable work, and if, as seemed probable, the demand increased in the near future, they hoped to get their fair share of the orders. The costing section was efficient, far-reaching, and ably handled, and the work of that section was greatly responsible for the improvements which had steadily taken place during the past year.

Major Darwin seconded the motion, and remarked that, despite the present balance sheet, his confidence in the future of the company was as great as it ever had been, and he hoped to remain on the board until a dividend was again paid.

The report was adopted unanimously.

Western Telegraph Co., Ltd.

The annual general meeting was held November 29th, Sir John Denison-Pender, G.B.E., presiding. The chairman expressed the company's regret at the recent death of Mr. John G. Griffiths, and then, turning to the accounts, said that the surplus, although smaller than in the previous year, was satisfactory having regard to the difficulties of the period. The position had been improved by reduced working costs and lower taxation payments, and consequently the rate of dividend had been maintained. Over £400,000 capital expenditure had been incurred during the year, the principal additions being cables between Pernambuco and Maranhao, Pernambuco and Maceio, and between Rio de Janeiro and Santos. The city of Victoria, on the Brazilian coast, had been connected to the system by duplicate cables to Bahia and Rio de Janeiro. The United States Government had rescinded its refusal to permit the landing of cables at Miami, Florida. The chairman was glad to say that there were signs of improvement in South American trade. The recent earthquake on the coast of Chile had broken numerous cables, but the repair ship had reached the spot within six days, and many of the breaks had been repaired. To take the place of the cable steamer *Cormorant*, which foundered on January 24th last, the company had chartered the cable steamer *Sentinel* until a new steamer, now under construction, was completed. It had also been decided to replace the *Norseman* with a somewhat larger vessel, which was being built.

The report and accounts were adopted, and in reply to a shareholder Sir William Plender said that the company had had to realise investments to provide funds for new capital expenditure. This accounted for the change in the amount shown in the balance sheet.

Anglo-Argentine Tramways Co.

The Times says it is reported that at a meeting held in Brussels the company decided upon a plan for funding the arrears of interest on the company's second preference shares. The company's issued capital consists of £3,200,000 5½ per cent. first preference shares, £2,500,000 5½ per cent. second preference, and £3,250,000 ordinary. All the ordinary capital is now held by La Compagnie Générale de Tramways de Buenos Ayres, but the preference capital is largely held by investors in this country. This once prosperous undertaking has been passing through lean times, and the interest on the second preference

shares is in arrears as from July 1st, 1918, which means an accumulation of arrears as on June 30th last of £550,000. It is intended to raise the rate of interest on the second preference shares from 5½ to 6 per cent., and to satisfy interest outstanding by an allotment of second preference shares carrying the higher rate. By this step the way will have been cleared for a resumption of dividends on the ordinary capital, which has been without any reward since 1914.

French Companies.

The accounts of the *Société l'Electro-Cable* show net profits of 2,543,000 fr. for 1921-22, as compared with 1,611,000 fr. in the preceding year. It is proposed to pay a dividend at the rate of 35 fr. per share, as against 50 fr. in 1920-21, a large balance being carried forward as a measure of prudence and also having regard to the recent increase in the share capital to 20,000,000 fr.

The report of the *Société des Accumulateurs Electriques* (late A. Dinin) states that the turnover in 1921-22 was greater than in the preceding year, and production on a large scale at the Nanterre works had resulted in favourable prime costs. Having regard to general conditions and the fall in prices due to very keen competition, the financial results ought to be considered satisfactory, the net profits being 839,000 fr., and the dividend (statutory) 6 per cent.

The *Compagnie des Etablissements Industriels* (Grammont) reports a deficit of 2,479,000 fr. for 1921-22. Speaking at the recent annual meeting, the chairman stated that it was now possible to expect a normal yield on the capital invested. Concerning the business expected to result from the electrification of the railways and the renewal of the telephone and telegraph network, the speaker stated that the particular expenditure which interested the company and its branches amounted to more than a milliard of francs spread over only a few years. It was conceivable that this enormous work would raise very keen competition among the few French manufacturers. As to the technical difficulties, he said that other nations had obtained some advantage during the war, but since then the French had resumed their position, and their English allies had shown themselves, personally with regard to the company, quite willing to allow the French to derive the benefit of their experience on most moderate terms. As a consequence the French industry would not be inferior to that of other countries either in the matter of cables or telephones. In conclusion, the chairman stated that he and the other French makers had confidence in the patriotism of the Government to entrust the works in question to the national industry.

The accounts and balance sheet for the working year 1921-22 of the *Maison Bréguet* shows a credit balance of 1,866,160 fr., being an increase of 125,245 fr. on the previous year. A dividend of 50 fr. gross per share was declared, half of which has already been paid on account. The company has concerned itself to sell ordinary machinery than to realise its mechanical and electrical specialities. With this end in view it has supplied this year to the national marine eight turbine motor groups for four 3,000-ton cargo boats and four oil tank ships. The results shown by these equipments had doubtless influenced the Minister of Marine's decision to equip the six torpedo-boat destroyers of the new naval programme with turbines of two systems, one of which is that of the company. Following up this the board has come to an understanding with two of the leading French naval shipyards that, should the latter secure the contracts for the ships, their plans will embrace the use both of Bréguet turbines and of motors, the latter developing 50,000 h.p. The new workshops at Douai, expected to be ready by March next, occupying 2½ hectares, of which 12,000 metres are roofed, have a plant of 1,800 h.p. and 130 machines, and represent a capital of 3,000,000 fr. These, with the Paris workshops, will be available for carrying out the naval programme.

The board of the *Energie Industrielle* has been empowered by a recent extraordinary meeting to raise the company's capital by the issue of 40,000 100-franc shares, payable in cash. The board was also authorised to issue a further 1,000,000 shares, to be employed in payment for the several undertakings it is intended to absorb. These are as follows:—The Usine électrique d'Oloron, the Société Haute Dordogne Force et Lumière, the Société d'Eclairage et de Force de Vougeot, the Compagnie de Fréjus et de Saint Raphaël et Services des Eaux de Fréjus, and the Compagnie Electrique de Menton. The acquisition of the network of the first-named company will give the Energie Industrielle a considerably enlarged field of action, its available power being 4,000 h.p., the agreed compensation being 6,500 shares; the consideration for the absorption of the second company is three ordinary shares of the Energie Industrielle for each 1,000 fr. shares of the Taute Dordogne company, the latter bringing in its newly completed hydro-electric station on the Dordogne; the third company brings into the common stock a 72-km. network of high-pressure lines and 20 km. of l.p. in the Côte d'Or and Saône et Loire; the fourth company owns the electrical concessions for the towns of Fréjus and Saint Raphaël, besides possessing two gasworks in the same towns; the fifth company also owns the municipal concession at Menton, drawing part of its current requirements from its own 1,800-h.p. peat station and part from the Briel station on the Roya, owned by the Energie Industrielle. These new resources are destined to give the greatest development and return to the business of the amalgamation. Future plans contemplated in the Landes and the Basses Pyrenées are the doubling of two hydro-electric stations and the creation of a great high-pressure network linked up to the various stations and concessions, for which further additions of capital will be needed.

German Companies.

The accounts of *Max Schorch & Co.*, electrotechnical works, of Rheydt, permit of the payment of a dividend at the rate of 25 per cent. for 1921-22, this comparing with 10 per cent. in the previous year.

The directors of the *Bavarian Telephone Works Co.*, of Munich, whose new works was brought into use shortly before the close of the financial year, recommend a dividend at the rate of 15 per cent. on share capital of 20,000,000 marks for 1921-22.

The directors of the *Telephone Works Co.* (late *J. Berliner*) recommend an increase in the rate of dividend from 20 per cent. in 1920-21 to 35 per cent. in 1921-22. At the same time the share capital is to be raised by 60 millions to 100 millions of marks.

The *Bank of Electrical Values*, which as an investment company is the present title of the former Berlin Electricity Works Co., reports net profits of 30,700,000 marks for 1921-22, as contrasted with 13,800,000 marks in the previous year, and the dividend is at the rate of 25 per cent., as against 18 per cent. It is now proposed to increase the share capital by 98,500,000 marks and redeem debentures for 55,000,000 marks.

The *Poege Electricity Co.*, of Chemnitz, states that the company successfully participated in 1921-22 in the work in connection with the supply of electricity in country districts, particularly in the erection of transmission lines for pressures up to 100,000 volts. After having made provision for depreciation, the accounts show net profits of 10,576,000 marks, as compared with 5,095,000 marks in 1920-21, and the rate of dividend rises from 12 per cent. in the latter year to 20 per cent. in 1921-22.

The *German Telephone and Cable Industry Co.*, of Berlin, reports net profits of 1,334,000 marks for 1921-22, as compared with 850,000 marks in the previous year, and a dividend at the rate of 12 per cent. and 8 per cent. in the two years respectively.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:

Toronto Power Co.—£2,544,623 4½ per cent. guaranteed debenture stock. British Columbia Telephone Co.—Six per cent. cumulative preference shares of 100 dols each; and 4½ per cent. first mortgage debenture stock.

The undermentioned have been ordered to be officially quoted:—

Pernambuco Tramways and Power Co.—£500,000 8 per cent. prior lien debentures, Nos. 1 to 5,000 (£100) (bearer), in lieu of the scrip now quoted.

Companies Struck off the Register.—The following companies have been struck off the Register and are dissolved:—

Institute of Medical Electricity, Ltd.
International Electrical & Mechanical Supplies Co., Ltd.
Mac Sparking Plug Co., Ltd.
Pebeo Accumulators, Ltd.
Simplex Power Generator Co., Ltd.
United Electrical Works, Ltd.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Final dividend of 3 per cent., less tax, being at the rate of 6 per cent. per annum on cumulative preference shares for the half-year ending December 31st.

Ferranti, Ltd.—The net profit for the year ended June, 1922, is £24,371, plus £16,123 brought forward. The directors submit a scheme for the reorganisation of the company's capital. The meeting is to be held on December 14th.

Waygood-Otis, Ltd.—Interim dividend on ordinary shares at the rate of 5 per cent. per annum.

Power-Gas Corporation, Ltd.—Dividend at the rate of 5 per cent., less tax, for the year ended September 30th, 1922.

Shawinigan Water and Power Co.—Dividend of 1¾ per cent. for the quarter ending December 31st.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1½ per cent. on the cumulative preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The leading motive in the Stock Exchange markets is governed by ease of money on the one hand, a key note which is rather subdued, however, by the approach of Christmas, and the uncertainty of the outlook abroad, on the other. A good deal of capital continues to flow into Stock Exchange markets for investment purposes, though evidence of the public's invincible determination to maintain the tradition of window-dressing at the New Year is very obvious. The prices of gilt-edged stocks are firm; the electric lighting

market is good; recovery has occurred in some of the cable stocks and the Government's unemployment proposals are having a beneficial effect upon shares in various commercial undertakings, particularly those in the Midlands and the North, that are considered likely to obtain orders in connection with the relief and other works which are to be set up.

Curiosity is agog to know in what manner electrification of the various railways is to be financed. Railway companies like private individuals, seldom keep a greater cash balance at the banks than is necessary for ordinary working purposes. If called upon to provide substantial amounts for improvements or extensions, the companies may have to go to their stock-holders for new money. This factor is influencing prices to some extent. The prior-charge stocks of the leading railway companies, however, are maintained exceedingly well, in spite of the expectation that, if new issues are to be made, they will take the shape of debentures or some other pre-ordinary class of security.

Metropolitan Consolidated, after its substantial improvement, eased off to 60½; Districts are quiet at 46, following their jump of last week, and the Underground descriptions remain somewhat quiescent. Amongst the stocks of those steam railway companies which propose to put in hand important schemes of electrification, the disposition is for prices to improve, though the public demand for investments of this kind is very fitful, and it takes but a small amount of selling to bring about reaction after any spurt.

Details are now available of the manner in which will be allocated the award of £133,367 to the East London Railway as compensation in respect of the control of the undertaking by the Crown during the years 1915-21. The directors say they are advised that this sum is to be treated as revenue, and that its allocation to any purposes to which the earnings of the company may be appropriately applied, is within their discretion. It is proposed to pay the holders of the second-charge "B" debenture stock £16 on each £100 of stock, and the price of the security has risen to 82. The third charge 4 per cent. debenture stock is to receive 2 per cent., and the price of this stock is unchanged at 18, while the ordinary remains at 4½. There may be some disappointment felt at the way in which the amount is split up. Optimism had rather looked for a distribution of some trifling sum on the ordinary stock. However, no particular opposition is likely to be raised, and meetings are to be held on Friday next week at which an individual stockholder of each class will be selected to represent the interests of his class of stock in proceedings before the court.

Brompton Electric ordinary have risen to 10½, owing, of course, to the share bonus which the directors are going to distribute. City of London ordinary are better at 23s. 1½d. South Londons are nominally 4½, but can be bought at the price. Westminsters at 7⅞ show a rise of 2s. 6d.; there are 250 on offer at 8, at which the return on the money, on the basis of the last 10 per cent. dividend, works out to 6½ per cent. City Lights can be bought at 44s. and the new County of London ordinary at 4s. 9d. premium, or a little less, equal to 27s. 3d. for the fully-paid; there will be a broken amount of dividend on these next time in consequence of the issue not being fully-paid yet.

Amongst the preference shares, selection is more limited, and apart from 500 Charing Cross 4½ per cents. offered at 4½, giving a return of 5½ per cent. on the money, there is not much to be obtained which gives this yield. County of London 6 per cent. preference are available at 23s. 3d., paying £5 3s. 6d. Yorkshire Electric 6 per cent. new preference at 21s. 9d., with a partial dividend in February next, afford 5½ per cent. on the money, and there are still a thousand or so of Scottish Power 8 per cent. preference to be had at 23s., at which the yield is nearly 7 per cent., taking into account the dividend due in February.

General Electric 7½ per cent. "B" preference at 21s. 9d., of which there are a thousand on offer, return £6 18s., and English Electric 6 per cent. preference at 18s. 6d. yield 6½ per cent.

The feature of the week in the tramway section is a rise of 15s. in Anglo-Argentine Tramways second preference. This has carried the price to 4½ and the first preference are also harder. The reason is simply that expectation looks for early publication of some scheme of funding the arrears of dividends on the second preferences, and it is hinted that any such scheme might involve an advance of ½ per cent. in the 5½ per cent. dividends. Brazil Tractions are two points down at 48, but the British Columbia stocks remain good and a further rise of three points has lifted the deferred to 89½. Mexicans are better on the whole, Mexican Light and Power preferred at 53½ being 2 up, though the common shares lost a point of their last week's advance.

West India and Panama Telegraph shares, after a long period of complete stagnation, have recovered on the announcement that the company is to be allowed to charge additional rates on its messages. The ordinary rose half-a-crown to 7s. 6d., the first preference put on 10s. to 40s., and the second preference at 25s. are 5s. up. The market is, however, more or less nominal, for there are more buyers than sellers. In the Eastern group, a better tone is discernible, with rises in Eastern Extensions, Eastern ordinary and Westerns. In fact, it may be said that the weakness of the last fortnight has been wiped out. Great Northerns at 28½ are 10s. up. United River Plate ordinary at 7⅛ show a gain of 5s., but the Marconi market is dull, the parent shares going back to 2½. The newly issued 6½ per cent. debenture keeps steady at 3½ premium over and above the issue price of 99.

Babcock & Wilcox hardened to 3 7/16, on the idea that engineering companies are likely to benefit substantially from the Government programme for provision of employment. Electric Constructions at 1⅛ are 1s. 3d. better, and Siemens strengthened to 22s. Metropolitan-Vickers ordinary are a better market at 28s. 9d. British Aluminium at 16s. 3d. lost a few pence. Otherwise the manufacturing market is very quiet. Rubber keeps firm, though not quite at the best which it recently touched. The market in rubber shares, after showing pronounced activity, subsided to some extent as regards the interest shown, without, however, prices going back to any noticeable extent. In the iron, coal and steel group, the passing of dividends by some of the principal companies in the business is partly offset by the hope that the renewed activity in the shipbuilding trade, coupled with the Government schemes for employment already mentioned, will have a favourable effect upon the fortunes of the companies concerned.

The South American Light & Power Co. announces that the Board are prepared to purchase any number, up to 50, of the 5 per cent. debentures of £100 each of this company. The circular adds that the "latest official quotation in the Stock Exchange Official List for these debentures is £71—£76 per cent." We may add that for some time past there have been buyers in the market, and very few sellers, so that a holder who cared to offer his debentures might not be unreasonable if he did so on the basis of 82 to 85 per cent.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Dec. 5. 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	10½	+ ½	£5 17 1
Charing Cross Ordinary	8	9	7½	—	5 16 2
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6⅝	—	4 9 0
City of London	14	14	23/-	+ 1/-	6 10 3
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7⅜	—	6 7 0
London Electric	2½	4	3	—	4 0 0
do. do. 6 per cent. Pref.	6	6	5⅛	—	5 17 1
Metropolitan	7	7	6½	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9½	—	6 9 9
South London	7	7	4½	+ ⅛	6 4 5
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅛	+ ⅛	6 7 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	102	—	5 17 6
do. Def.	1½	34/6	23½	—	6 9 0
Chile Telephone	6	6	6¼	—	4 16 0
Cuba Sub. Ord.	7	7	8	+ ⅛	8 15 0
Eastern Extension	10	10	19½	+ ⅛	5 4 0
Eastern Tel. Ord.	10	10	190½	+2	5 5 0
Globe Tel. and T. Ord.	10	10	19½	—	5 4 0
do. do. Pref.	6	6	11⅛	—	5 7 10
Great Northern Tel.	24	22	28½	+ ½	7 14 4
Indo-European	10	10	35½	—	7 1 0
Marconi	25	15	2⅛	— ⅛	7 1 2
Oriental Telephone Ord.	12	12	2⅞	—	*5 4 0
United R. Plate Tel.	8	8	7⅛	+ ⅛	*5 5 0
West India and Panama	Nil	Nil	7/6	+ 6	Nil
Western Telegraph	10	10	19⅛	+ ⅛	*5 4 7
HOME RAILS.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	60½	— ½	3 14 5
do. District	Nil	1	46	—	2 8 6
Underground Electric Ordinary	Nil	Nil	3	— ½	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	3⅝	+ ⅛	7 2 0
do. do. 2nd Pref.	Nil	5½	4⅜	+ ⅛	5 19 0
do. do. 5 per cent. Deb.	5	5	82½xd	—	6 1 3
Brazil Tractions	Nil	Nil	48	—2	8 6 8
British Columbia Elec. Rly. Pcc.	5	5	80	—	6 5 0
do. do. Preferred	5	93/-	77½	+1	*6 2 6
do. do. Deferred	3	124/-	89½	+3	*6 18 8
do. do. Deb.	4½	4½	80	—	5 6 3
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	—	6 2 8
do. 6 per cent. Bonds	Nil	Nil	55½	—	Nil
Mexican Light Common	Nil	Nil	22½	—1	Nil
do. Pref.	Nil	Nil	53½	+2	Nil
do. 1st Bonds.	Nil	5	68½	+1	7 6 0
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	3 7/16	+ 1/16	4 13 10
British Aluminium Ord.	10	5	16/3	—6d.	6 3 1
British Insulated Ord.	15	15	2⅝	—	6 17 0
Callenders	15	15	2⅜	—	7 1 2
do. 6% Pref.	6½	6½	1⅜	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	2/6	—	Nil.
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅛	+ 1/16	7 5 6
English Electric	8	5	15/-	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 8 0
Gen. Elec. Pref.	6½	6½	21/9	—	5 19 6
do. Ord.	10	5	17/0	—	5 17 8
Henley	15	15	2⅛	—	6 11 3
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	12/6	—	—
Met.-Vickers Pref.	8	8	28	—	6 14 9
Siemens Ord.	10	10	1 3/16	+ 1/16	—
Telegraph Con.	20	20	23½	—	*4 13 6

* Dividends paid free of Income Tax.

CAUSES OF TRANSFORMER FAILURES.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

(*Concluded from page* 817.)

15. Coil conductors may be violently displaced on the occurrence of an external short circuit, as the result of internal unbalanced electromagnetic conditions. With concentrically wound primary and secondary coils (as in the rectangular core type of transformer) the horizontal axes may not coincide, and therefore a vertical force acting upon the coils is introduced in addition to the usual radial one. This vertical force has often been responsible for the distortion of end coils, particularly of the older designs of transformers in which the impedance was low. When a number of pressure-adjusting tappings are fitted, it is often very difficult to preserve electromagnetic symmetry at all ratios, and sometimes the unbalancing is unavoidable.

With sandwich-wound primary and secondary coils (as in the rectangular shell type of transformer) the axes of the individual coil sides may not coincide on account of the differences required in electrical clearances from coils to core, and of the differences in winding spaces. In this case the lack of symmetry introduces distorting forces acting radially upon the coil sides, which become pushed in towards the core and forced out away from the core, depending on the relative positions of the axes of the coil sides and upon the relative short circuit currents flowing.

16. Short circuits between turns, breakdown of windings to earth, and puncture of insulators may take place due to the following transient phenomena:—

(*a*) Concentration of potential on the terminal end coils when switching-in or when lightning discharges reach the transformer. Owing to the change of surge impedance at the transition point between transformer and line, the phenomenon of reflected and transmitted pressure and current waves occurs, which may produce high voltage rises in the transformer windings. While the end coils bear the brunt of the shock, the remainder of the windings is not immune against breakdown, as high voltages may still penetrate any part of the windings.

(*b*) The concentration of potential on the end turns referred to above may be increased if a cable of high electrostatic capacity supplies the transformer. In effect each phase of the transformer is shunted by a capacity to earth which must be charged up before the disturbing wave can proceed, and the greater this capacity the longer will it take to charge up. Hence the pressure concentration on the end turns will also occur for a longer period of time.

(*c*) An effect analogous to (*b*) is produced by reinforcing the insulation of the individual conductors of the end coils. This decreases the electrostatic capacity between turns, and therefore the ratio of capacity to earth and capacity between turns is increased, and pressure concentration will be more intense.

(*d*) The phenomenon of reflected and transmitted pressure and current waves may also occur at open-ended tappings, at any point of change of surge impedance in the windings (such, for instance, as at the termination of conductor reinforcement, or at the space between series coils), and at the neutral or mid-point. Care should be taken to insulate the conductors in these regions very thoroughly, in order to eliminate so far as possible short circuits between turns.

The disturbing cause may be either ordinary switching-in, lightning discharges, an arcing ground, chattering switch contacts, or single pole connection by advancing switch spark.

(*e*) Internal local resonance of the coils may occur under the influence of any of the exciting causes mentioned under (*d*). This danger is perhaps somewhat remote.

(*f*) When switching-out of circuit a highly inductive winding, such as a transformer primary with the secondary open circuited, the magnetising current, and consequently the magnetic flux, tends to collapse instantaneously. While due to various reasons the flux does not do this, it does sometimes drop at a much more rapid rate than that corresponding to the normal cyclic rate of change, and as a result high pressure rises are sometimes produced. The rapid cooling of the interrupting arc, particularly during the last half cycle, has been found to augment this effect.

17. Sustained heavy overloads produce high temperatures throughout the transformer. The coil insulation becomes brittle, and in time probably flakes off the conductors in places, so producing short circuits between turns. The oil deposits sludge both on the tank bottom and on the coils and core structure. This deposit exerts a blanketing effect on the coils and core, so that the excessive heating becomes cumulative in effect. Narrow oil ducts also intensify the heating. Transformers with a high ratio of copper loss to iron loss are less able to withstand overloads, and are, therefore, more liable to fail on account of the troubles arising from this phase of operation.

18. When changing over tappings, the terminals of which are arranged on a single board, say, under oil level, wrong leads may be joined and part of the windings may be short-circuited. Heavy currents would then circulate in the short-circuited winding, which would produce a fault between turns unless the transformer was very speedily tripped out of service.

19. Bolted joints or connections carrying current may, if not very effectually locked, become loose in service, due perhaps to some slight vibration. Such joints will rapidly heat up, and even so trivial a fault may temporarily place a transformer out of commission.

(C)—Breakdowns in the Dielectric Circuit.

1. Moisture entering the oil as a result of the so-called "breathing" action greatly reduces its dielectric strength, so that breakdowns from coils or terminal leads to tank or core structure may take place. The greatest danger, however, is to the "minor" insulation of the coils, as previously referred to.

2. Deterioration of the oil may occur as the result of prolonged overloading of the transformer, and the action is materially assisted by the presence of bare copper and lead. Excessive oil temperature produces the formation of sludge, water and acids.

3. Dielectrics having different specific inductive capacities are often used in series, and unless their thicknesses are properly proportioned, they may be subjected to abnormally high dielectric stresses. For instance, the insulation between h.p. and l.p. transformer coils usually consists of cotton, linen or empire tape, bakelite and oil. Except in very high voltage transformers, the effect of the cotton covering and of the tape can be ignored, so that we only have to consider bakelite with a dielectric constant of 5, and oil with a constant of 2. The total pressure across two such dielectrics in series divides up so that the pressure across each is inversely proportional to the dielectric constants, and unless the respective thicknesses are proportioned so that the pressure gradient across each is within the safe working limit, first one and then the other dielectric will fail, due to corona discharge and overheating.

4. Corona may take place from sharp conducting edges or small diameter conductors if the surface pressure gradient is high. Corona discharge may also occur across the air space between the oil and tank cover of high voltage transformers. This can be remedied by short circuiting the air space.

5. Insulating parts, such as cylinders, tubes, and

terminal boards, made of compressed paper bonded with synthetic resin, may occasionally have their surfaces contaminated during the manufacturing processes, or they may hold occluded air. The former fault is responsible for surface discharge, which renders the material useless, and, when occurring, generally does so on terminal boards. The latter imperfection usually results in complete puncture of the insulation concerned, as a result of ionisation of the occluded air and subsequent overheating of the dielectric. When this type of breakdown occurs, it is usually with cylinders and condenser terminals.

6. Earth shields placed between primary and secondary windings have been responsible for numerous breakdowns. Their presence produces a concentration of dielectric stress at their edges, which tends to strain the near-by insulation, while a breakdown at one point from the h.p. windings to the shield has often resulted in almost completely destroying the h.p. and l.p. windings on the limb concerned.

7. Narrow oil ducts are a serious menace to the serviceable life of a transformer. Adequate cooling cannot be obtained, the coil insulation becomes brittle in time, and a fault between turns naturally follows.

8. Occasionally metallic particles are found in the various kinds of pressboards, and these may result in a puncture of the board.

9. Careless workmanship may result in solder splashes on the coils and on surfaces which are depended upon for creepage clearances. The possible effect of these will be obvious.

10. During the course of time a certain amount of the oil disappears, due to evaporation and oxidation. Unless the oil is topped up to the proper working level, the transformer will overheat on account of the consequent loss of tank radiating surface and of the cooling medium.

11. Short circuits between phases may occur if there is insufficient clearance between the phases. This may be aggravated by the insertion of a pressboard barrier between phases if the presence of the barrier upsets the distribution of dielectric stress to such an extent as to throw too high a stress across the oil spaces and across the barrier.

12. If wood cleats which, for instance, support the terminal leads from coils, are not very thoroughly dried and impregnated, the moisture present will lead to burning of the wood and possibly to a short circuit between tapping leads.

13. In some instances the relationship of the electrostatic capacities between primary and secondary windings, and between individual windings and the core, may lead to the presence of high voltages in the low-voltage circuit. The solution of the problem is really one of earthing, and has been dealt with in a paper published in the Electrical Review in 1915.*

14. The presence of foreign conducting particles held in suspension in the oil may cause a temporary breakdown, due to the lining up of these particles between bare parts, having a difference of potential across them. Examples of this are the flashing over under oil of terminal leads to each other, and to the tank or core structure.

(D)—Breakdowns Due to Various Structural Defects and to Other Causes.

1. Core-type transformers fitted with adjustable axial coil supports usually have the necessary mechanical pressure for taking up the adjustment transmitted to the coils through heavy steel clamping rings. These rings have a gap in them in order to prevent the circulation of large short-circuit currents. Cases have arisen in practice where this gap has been bridged, and the steel ring melted in consequence.

2. Insufficient bracing of the leads from coils to terminals may result in these becoming distorted and making contact in the event of an external short circuit taking place on the system. The danger becomes very acute on large systems on account of the heavy short-circuit currents which may flow.

3. Transformer tanks, unless very careful attention is given to them, are a potential source of trouble. Bad welding, spongy plates, ungalvanised cast iron, and leaky fittings all lead to oil leakage and consequent overheating and breakdown of the transformer, if not attended to immediately. Rough handling in transit is also responsible for a large proportion of the leaky tank troubles.

4. Deposits of ordinary dust, coal dust, and salt spray on the surfaces of leading-through insulators often cause these to flash over to the case. The remedy is obvious.

5. In heavy current, low-voltage transformers, such, for instance, as are used for supplying electric furnaces, a number of coils each consisting of a number of heavy conductors in parallel are also connected in parallel. It sometimes becomes a matter of difficulty to design the low-pressure winding so that all the parallel paths between terminals will have the same impedance. If they do not, however, they will not share the load equally, and parts of the winding will overheat, with the usual inevitable result.

6. Transformers operating in parallel should preferably possess the same turns ratio, the same percentage impedances, and the same ratios of resistance to reactance drops. If any of these factors are different, one transformer at least will be overloaded, and may consequently burn out. This subject has been fully treated in a paper published in the *Electrician* in 1917.†

7. Heavy-current leads between furnace transformers and the furnace should be laid out so as to keep the impedance of the circuit within desired limits. If care is not taken to attain this, the voltage applied to the furnace will be very considerably below that required for successful operation. A case is on record where the l.p. leads formed a loop round an iron column supporting the building, thus increasing the inductance of the l.p. circuit and pulling down the pressure applied to the furnace.

8. When housing transformers, care must be taken to provide sufficient space around them so as to enable the tank to dissipate the losses. If a transformer is placed too near to another one or to the walls of the chamber, the tank will become lagged, and the temperature of the transformer will increase, so endangering the coil insulation and the condition of the oil. It is essential to provide adequate ventilation for all transformers. Closed pits and small brick chambers should be avoided wherever possible. In the case of furnace transformers, effective shielding should be interposed between the furnace and the transformers.

9. As the vapour at the top of the tank of oil-immersed transformers is of an explosive nature, a naked light should never be introduced for the purpose of examination of connections, &c. A case is on record where a transformer was wrecked and loss to human life sustained through neglect of this precaution.

10. The temperature of artificially-cooled oil-immersed transformers will increase to prohibitive figures if a stoppage of the cooling medium occurs due to some failure in the auxiliary cooling plant. If such a failure does happen, the load on the transformer should be decreased to such a value as it can handle as an ordinary self-cooled transformer without attaining an excessive temperature rise.

11. In water-cooled transformers the cooling tubes are liable to become clogged, due to deposits of lime or other matter from the water supply. If the tubes are not thoroughly cleaned out periodically, the water flow becomes lessened, and the transformer will attain a tem-

* "High-voltage Dangers Present in Static Transformers due to Electrostatic Capacity of the Windings," by J. Lindley Thompson and S. Austen Stigant. Electrical Review, January 1st and 8th, 1915.

† "The Parallel Operation of Static Transformers," by J. Lindley Thompson and S. Austen Stigant. *Electrician*, February 9th and 16th, 1917.

perature higher than the maximum permissible with the usual subsequent results.

12. Cases are on record where electrolytic corrosion has occurred in transformer oil coolers, due to the use of metals in actual contact, which are situated far apart in the table of electrochemical equivalents. The remedy, of course, is to use metals in contact which are as near together in the table as possible.

Conclusions.

A study of the records of modern transformer breakdowns which have occurred over a period of years shows very conclusively that between 70 and 80 per cent. of the number of failures are finally due to short circuits between turns, and a perusal of the foregoing lists will indicate that this may be caused in a number of different ways. Unfortunately, with a fault of this type it is usually very difficult to say definitely exactly what the failure has been due to, as all evidence is eliminated, as a rule, by the very nature of the breakdown. Consequently, the cause of the breakdown is often a matter for conjecture, and however unsatisfactory this may be from a point of definitely assigning the true cause, usually a very close idea of the real cause may be obtained by a careful study of the transformer itself and of the local and operating conditions. The foregoing review may further assist in determining the true cause.

The remaining percentage of breakdowns can often be minimised by provision of suitable transformer protective apparatus, and by regular and careful supervision of the transformers themselves, and of the operating conditions.

SOUTH AFRICAN TRADE AND INDUSTRY.

A report on South Africa, by H.M. Senior Trade Commissioner, has just been issued by the Department of Overseas Trade (price 1s. 6d.). After describing the consequences of the slump which occurred at the beginning of last year, Mr. Wickham alludes to information which was gathered in all parts of the United Kingdom that steady small replacement business was coming forward from South Africa in most lines. He adds, however, that there is no appearance of confident and large-scale forward buying.

No discouragement need be felt, for the United Kingdom seems to be obtaining its normal share of all the business that is passing. That this has been occurring for some time is brought out by a comparison which Mr. Wickham makes of the trade statistics for 1921 with those of the previous year.

The most noteworthy fact as to the character of imports is that in spite of a steep fall in cost, there is an increase in the total value of mining, manufacturing, and other machinery from £4,250,000 to £4,500,000, and an increase in electrical machinery and goods of £250,000. Similarly the Union Government's importations of machinery, rolling stock, and locomotives are approximately equal in value to those in the preceding year, and are therefore much greater in volume.

Foreign Competition.

There is a very marked falling off in Japanese competition, and a further loss of ground in the South African market by the United States, but an increased proportion of German goods. German competition is seen to be patchy—a feature which is becoming increasingly pronounced in many markets. For example, her imports of machinery aggregate only £89,000, as against over £1,000,000 from the United States, and electrical machinery and apparatus only £25,000. Again, whilst there was a notable importation of steel pipes, valued at £66,000, the entry of cast iron pipes to a value of £27,000 is less than normal.

The gradual reversion of trade into pre-war channels has reduced the American share of South African trade considerably. Some of the most important items of interest to the engineering trade are shown below :—

Imports from United States (1921).

Mineral oils, greases, and wax ...	£2,000,000
Machinery	1,087,000
Electrical goods	603,000
Iron and steel	279,000
Railway and tramway material ...	95,000
Tools (including machine tools) ...	140,000

On the whole, the imports of machinery in relation to foreign competition may be considered satisfactory. Of the total importation of electrical machinery and goods, including cable and wire, the United Kingdom and the United States of America shared about 96 per cent., in proportions of roughly 2 to 1. The American share is slightly larger than in 1920.

In the general machinery section the most important groups are "general manufacturing" and "mining." Of the former, the United Kingdom supplied over £1,000,000, as against £250,000 from America and £42,000 from Germany. Of mining machinery, £554,000 worth came from the United Kingdom and £347,000 from America.

Of the small quantity of machine tools (£22,000), America supplied nearly half. Of pumps, Switzerland and America shared half the supply. Of cranes, Canada supplied goods to a value of £20,000 and America £15,000. Half the printing machinery supplied was American. Of £22,000 worth of plant for confectionery manufacture, Germany supplied one-third.

In view of the constant inquiries as to openings and agents for petrol and oil engines, it is perhaps worth calling attention to the fact that the total importation for the year is set down at £43,000, of which 72 per cent. was British.

Automatic Telephone Extensions.

Over 63 per cent. of the small general trade in telegraph and telephone material was British. The preponderance of Swedish material imported by the Government is of course due to the nature of the existing telephone installations. As in the case of New Zealand, the British branch works are not allowed to supply this market. It is to be hoped that when automatic telephones become general, British works will be able to compete. The business in railway material, apart from the Government railways, is not large. The United Kingdom took second place to America in locomotives and supplied 25 per cent. of the light rails. Tramway rolling stock is being built locally to an increasing extent. Of such orders as were placed overseas, 75 per cent. went to America.

Mr. Wickham solicits support for the South African Association of British Manufacturers and their Agents, particularly in view of the projected revision of the Customs tariff next year. He points out that in the case of legislation of this kind it is useless for manufacturing interests in the United Kingdom to sit still and wait for information as to concrete proposals to reach them. By the time they have been studied and criticisms have reached the Union, it may be too late to secure amendments even of the most reasonable character. The Association is well equipped and eager to assist in such matters, and is prepared to make representations also in any case of unfair conditions of tendering or inequitable incidence of taxation or legislation generally.

Local Manufacture.

A particularly interesting section of H.M. Trade Commissioner's report is devoted to the problem of industrial development in South Africa. He agrees that from the point of view of British trade as a whole, the matter is not of vital importance, because if the Union embarks definitely on a policy of industrial expansion, the United Kingdom can supply machinery and manufacturers' requisites quite as easily as finished goods. The individual supplier will, however, be affected. Whether it is a question of continuing to import certain lines or of deciding to establish branch factories on the spot, the cost of distribution, particularly in the interior, is an important factor. With regard to bulky goods, such as iron and steel products, glassware and earthenware, domestic hollow-ware, steel trunks and tin boxes, furniture and many other lines, the raw material has for the most part to be imported if the goods are to be manufactured in the country, but the cost of transport of the finished article is so great compared with that of the material, that manufacture on the spot shows considerable saving.

On some classes of heavy goods, the railway freight rate for distances such as from Durban to Johannesburg is considerably higher than that by sea from Europe to South African coast ports. Actual instances can be multiplied, just as parallel cases in the United Kingdom itself may suggest themselves in relation to the cost of distribution of local products from one part of the country to another in competition with imported goods. In South Africa, however, the distances are so much greater, the towns smaller, and owing to the comparative paucity of traffic over the railway lines the cost of transport, of necessity, so much higher.

Reporting at the end of September last, the United States Trade Commissioner at Johannesburg says that the import statistics would indicate that the electrical trade must have "touched bottom," and that in the total statistics for the entire year some recovery should be recorded. He adds, however, that local stocks are about normal, and that no great increase in imports can be looked for as the result of any need to replenish them.

The large number of bids received, where quotations have been asked for, indicates the keenness of competition in the South African market. A recent tender for lamps put out

by the Johannesburg municipality brought fifteen offers covering products from six different countries: the United Kingdom, Holland, Germany, Switzerland, Austria, and the United States. The total value of this contract was only £1,342.

At the same time, the trade Press of South Africa sees a distinct improvement in the local market for electrical supplies, and it is noted that inquiries are numerous and orders increasing. Prices are generally firmer. There is also, continues the Trade Commissioner, the promise of considerable expansion in business, in view of the installation of new electric lighting plants and extensions of existing power stations. It is also an encouraging fact that many municipal building schemes, requiring considerable electrical equipment, have still to be completed.

To the foregoing summary of the remarks of the British and United States Trade Commissioners may be added the following figures of South African imports of electrical goods during the first seven months of this year and last:—

	1921	1922
	£	£
Batteries, primary	22,634	5,500
Batteries, secondary	24,815	9,000
Cables and wire	248,000	104,000
Heating and cooking apparatus ...	32,000	15,000
Lamps, incandescent	96,000	47,000
Motors and parts	156,000	51,000
Transformers	45,000	9,000
Material and machinery, n.o.d. ...	648,000	276,000

DOMESTIC LOAD BUILDING.

Suggestions upon Propaganda Work.

By W. A. GILLOTT, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The object of this paper is to show some of the channels open to electricity supply undertakings for securing the domestic load. In certain districts it might be fatal to adopt a too progressive attitude, and one must therefore lead up to the point by suggestion; in others it may be found desirable to combine the development scheme, such as an educative campaign, by actual demonstration with Press and other advertisements. These methods are briefly discussed and a skeleton scheme (which has been embarked upon by certain authorities) of one year's propaganda campaign is outlined.

The author's remarks are not put forward as definite proposals as to how matters should proceed, but merely as a suggested principle upon which the framework of an organisation can be constructed to deal with the business.

The first matter that should receive attention is the personnel. From the chief engineer to, at least, the sales representatives each individual should possess an adequate knowledge of the subject of domestic electrification before attempting to advise others. In addition, an electrical installation, complete in every detail, should be in the homes of such members of the staff to enable them to thoroughly appreciate their operation, establish a belief in the commodity, and encourage prospective consumers.

It is desirable to keep a careful set of records and a two-part tariff, with a comparatively high fixed charge, and with the charge per unit so low as to provide a satisfactory return, is desirable; the fixed charge should be sufficient to cover a consumer's normal lighting costs when the low unit charge is added. In other words, his lighting account would be practically identical under this tariff with what it would be under the standard flat rate which may be in operation. This provides a safeguard against supplying the consumer at a loss, and it is only upon an increased consumption that he obtains the benefit of the cheaper units.

Taking 1 kW of lighting installed, under average conditions the normal consumption would be approximately 300 units per annum, thus:—

Flat rate, 300 units at (say) 8d., £10. Two-part tariff, fixed charge per kilowatt (lighting) installed (say) £8 10s., plus 300 units at (say) 1½d., £1 17s. 6d., total £10 7s. 6d.

The lighting account remains, for all practical purposes, unaltered. If such a consumer installs a cooker, catering for six persons, his consumption would be increased by approximately 1,750 units per annum, making:—

Fixed charge as before £8 10s., plus 2,050 units (lighting and cooking) at 1½d. £12 16s. 3d., total £21 6s. 3d.

The average price obtained per unit will be approximately 2¼d. It is good business to prove to a consumer that his adoption of a domestic or multi-part tariff does not increase his normal lighting account, and that wastage or extravagance in the use of light is costing him only 1½d. per unit, which can for practical purposes be ignored. He will then see that his cooking, heating or power is charged at this low rate and he will appreciate the change. The education of the consumer upon this point will be of great value, as he will learn to look upon his supply as being given at 1½d. per unit, and regard the fixed charge as a rental. Such an installation would create a maximum demand of approximately 3.5 kW, which would occur about mid-day, *i.e.*, at a time when the majority of generating stations could deal with the load. An increase of 3 kW of heating and 2 kW of auxiliaries would make but little difference to the maximum demand, this being approximately 5.5 kW, and then only in winter time, but the total consumption would be in the neighbourhood of 3,500 units per annum, representing, on the basis given above, an amount of £30 7s. 6d., *i.e.*, an increase of £20 7s. 6d. above the ordinary lighting returns.

Taking 500 of such consumers on one system, the maximum load installed would be 6,000 kW; the maximum demand on the station would not, however, owing to the high diversity factor, exceed 600 kW. The consumption of the whole would be 1¼ million units, and the revenue approximately £15,200.

One of the most important characteristics of this class of business is its continuity; in contrast to the industrial load it is unaffected by strikes or lock-outs, and this should increase the desire to cultivate it.

The accompanying curves indicate the nature of the load upon the Billingham Housing Estate and show the result of the demand of 25 houses only, *i.e.*, approximately one-third of the whole village.

The details of the installation of each house are: one cooker, one wash boiler (10 gallons), one fire, kettle or iron, lighting.

The average number of kilowatts installed at each house is 11.28, and the total connected load is 282 kW. The pressure at the consumers' terminals is 250 volts. The highest demand (approximately 31 kW) occurred on Sunday, December 11th, at 12.30 p.m., and lasted for only a few minutes, the average maximum demand being in the neighbourhood of 24 kW. The returns, being taken in winter time, are consequently at their maximum.

On Sunday much cooking is done, and a certain amount of heating is carried on from breakfast (8.15 a.m.) to 2.30 p.m. There is a short period of rest before tea is prepared, about 4 p.m., and at 6.30 p.m. the load quickly drops to the normal lighting demand, as is the case on each day of the week.

The morning load on Monday and Tuesday is due to the wash boilers and cooking. Monday's curve indicates that the boilers are in operation soon after 8 a.m. and that the cooking load is not so heavy, as probably no mid-day meals will be cooked. On Tuesdays almost the same conditions apply, but more cooking is done, as shown by the demand from 12.30 p.m. to 2 p.m. Thursday is the bread-baking day, as shown by the comparatively longer period of demand. Saturday appears to be a day of "put-off" meals.

These curves give much information, and one is able to estimate with accuracy the size of feeder cables necessary for a district. They amply prove the load to be a daytime demand, and that it is continuous, *i.e.*, it is an everyday load. The high diversity factor is well demonstrated, and proves the value of the load to an undertaking. It is possible for the domestic load on many stations to be larger than the industrial load. The curve for Sunday and that of a gas company's output on a similar day are identical in shape, and the value to the gas company of 5 hours' Sunday's load is equal to that of a whole week-day's combined domestic and industrial load.

The author suggests that the Institution might consider the advisability of investigating the matter in detail and submitting a report upon its findings. The Electrical Development Association has obtained certain information of a general nature, and by co-operation most valuable assistance could no doubt be given to the industry.

Considerable revenue can also be secured from commercial cooking. For four installations, including three staff feeding kitchens and one restaurant, totalling some 452 kW connected, the total number of units consumed was 290,000 per annum, and the resultant maximum demand was 190 kW (approximately).

Many small undertakings are not at present in a position to handle a big demand for cooking and heating. It is suggested, therefore, that a start should be made upon a small scale and it will be found that if auxiliary appliances are used, their existence will have a greater effect on the financial returns than on the station maximum demand.

Unless one has lived in an electrically equipped home it is almost impossible to realise its worth.

For the hire of cookers, if a rental of 20 per cent. per annum on the net cost be established, it will provide a satisfactory

return on the capital invested and cover the cost of maintenance.

Those undertakings where the cooking load is not required so rapidly as when simply hire is established may conduct a hire-purchase scheme, which does not involve as much capital outlay and will encourage the consumer to handle the appliances with greater care. Political conditions prevent certain undertakings from supplying appliances under this plan, but the formation of a company to conduct such work, as mentioned by Mr. C. H. Wordingham at the Sanitary Congress, would overcome the difficulty.

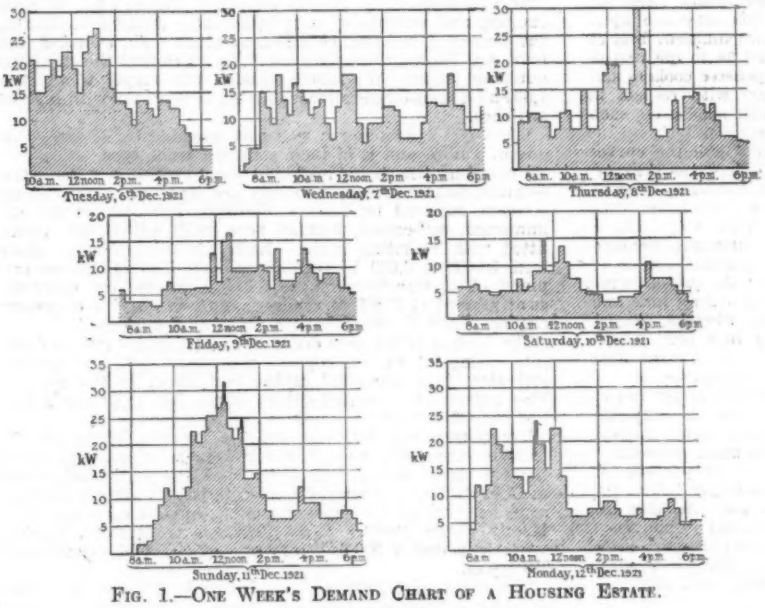


Fig. 1.—One Week's Demand Chart of a Housing Estate.

Discussion in London.

Mr. L. L. Robinson pointed out that the public was ready for the reception of propaganda on the subject. They were fond of discussing generation costs, but did not seem to bother about whether their services were being used as they should be. The most important part of the paper was the load chart, a study of which would dispel many old fears about peaks clashing, &c. He was now installing cookers in whole streets, and hoped to have similar charts available before long. A two-part tariff was good, but the second charge was invariably too high for the electrical "whole hogger." Before long it would probably be possible to allow the user as many kW points as he liked at, say £8 each, plus ½d. or ¼d. per kWh which, in conjunction with a limiter, would allow him when not cooking to use the energy for water heating. The cost of the previously-used coal and gas would pay for the kW charge and the electricity would only cost ¼d. per kWh.

Mr. H. Berry emphasised the fact that they must secure the right men to pass their propaganda on to the prospective user, and the right men should be adequately remunerated; it was a matter of the personal element. The kW points should be regarded as the hose pipes through which the consumer drew his electricity, which cost only ¼d. The combined coal, gas, and electricity bills would pay for a "service" the like of which they had not dreamed of. "Service" was all important; everything was ready to provide it, and the public wanted it. There was no question of the ultimate result.

Mr. J. W. Beauchamp explained that the subject under discussion was increasing in importance at such a rate that it could be regarded as a fit one to be discussed at the Institution meetings. They should have guessed many of the facts the author had pointed out, but the fact remained that they had not done so, and it was, therefore, proper to reiterate them occasionally. Load curves of single house were quite different things to those relating to groups of houses, and the more of the latter they could get the better. He would like to see engineers devoting more study than they did to methods of putting propaganda before the public.

Mr. W. R. Cooper said the housewife's point of view was: What does a mere man know about cooking and washing? In the paper the word "he" had been used where it would have been better to use "she." Women were much more efficient at "spreading the news" amongst their friends than men were.

Mr. W. Rawlings thought there was no question about the supply authorities being able to offer cheap energy and the manufacturers' ability to provide the apparatus, but they could not deliver their goods. The contractor was the man to supply the goods to the consumer, and there was much need of co-operation between the three. Although the supply authorities would spend much money on advertising they would not assist the contractor by giving him a rebate on the energy he used for demonstrating devices, &c., in his show-rooms.

Mr. A. C. Cramb approved of electrical engineers using electrical apparatus in order to prove its merits, but it was difficult, he said, to convince an electricity committee of that desirability, and so they were handicapped. The two-part tariff was good, but when introducing it they were liable to be accused of trying the therm dodge—ignorance, of course, and if it was explained properly it would be taken up at once. That some supply authorities were not allowed to sell electrical apparatus or let it out on the hire-purchase system was due to the Electrical Contractors' Association, and it was up to the Association to carry out those functions if it would not allow others to do so.

Mr. A. N. Rye said that the smaller concerns were not in a position to offer such attractive rates for electric cooking and heating as the larger ones were. The former should, therefore, concentrate on encouraging the use of small apparatus, and leave the larger plant alone until they were ready to consider re-laying their mains. The concerns he was connected with had succeeded in placing 8,000 (net, excluding disconnections) pieces of small apparatus in use within four years, which showed that such devices were popular even if the energy had to be paid for at the lighting rate in some cases. They could offer apparatus on the hire-purchase system by all means, but the hire of such devices was quite another matter, and its success was questionable.

Mr. C. J. Baker declared that it was still cheaper to cook on a coal fire or gas stove, and it would, therefore, need very seductive propaganda to introduce electric cooking. He also referred to the desirability of making all plugs and sockets for portable apparatus interchangeable, and thought it would be no great difficulty to preach a sermon on standardisation.

Mr. Young called for action and not mere words. "Service" was essential, and the gas companies were giving it; they must not only sell apparatus, but be prepared to keep it in working order. A very big lever in the hands of the gas authorities was their knowledge that electrical men often did not use electrical apparatus themselves. To obviate that difficulty an enterprising company had taken a step in the right direction by offering electrical men apparatus at a cheap rate; its example should be followed by the wiring contractors and electricity supply authorities.

Mr. W. A. Gillott, in replying to the discussion, said that the tariff was a very important item, and should be so simple that anyone could understand it. The contractor was as essential as any other party in an electrical venture, but there was need for co-operation. He denied that it was cheaper to use coal or gas than electricity, and quoted instances in support of his contention; moreover, a cook could use an electric range without any previous tuition. Unless they were prepared to give "service" it would be useless to go in for the business.

Discussion at Newcastle-on-Tyne.

The above paper was also read and discussed at a meeting of the North-Eastern Centre of the Institution on November 27th, Mr. F. G. C. Baldwin presiding.

Mr. W. F. T. Pinkney, in opening the discussion, thought that it was the first frankly commercial paper brought before them, and the fact that the I.E.E. had accepted the paper showed that it was realising that the engineering side was not the only one that had to be considered, and also that the domestic load was possibly the biggest field for development in the future. They had rather toyed with the domestic load perhaps, because they did not know exactly what effect it would have on the mains, and they had no records. A domestic boom was coming along, and customers were relatively easy to get and retain. Mr. Gillott had mentioned 300 kWh per kW for lighting; that figure was too high, but where a cooker was installed it was probably about right. It was implied that an improvement in the efficiency of cookers would reduce their consumption, but that would not prove to be the case. The tariff suggested in the paper was greatly to the advantage of the supply companies because it gave them a fixed minimum of revenue. All sections in the electrical industry were interested in the development of the domestic supply.

Mr. W. Cross said that in recent months more attention

had been given to the selling side of the industry, which had hitherto been too little regarded. It was, therefore, pleasing to get some definite facts which they could put before customers, for previously there had been too much variation. He had not found the "labour-saving" argument very helpful in his efforts to extend the sales of those devices, and little heed seemed to be paid to what the engineer called efficiency. If a man had the domestic work to do the labour-saving contention would bear much more fruit. There should be more co-operation between the supply companies and those who supplied the fittings, so that the canvassers could agree on their arguments and figures. The effect was very bad upon a possible consumer or purchaser when two different sets of figures were placed before him. He agreed as to the desirability of the hire system with regard to expensive cookers and similar apparatus, but it was not necessary with respect to cheaper articles, the rate of hire for which should be such that it was cheaper to purchase than hire them.

Mr. R. D. Spurr assumed that they could take the curves in the paper as representing the load of better-class artisans' houses, but curves taken in another town recently gave a very different set of figures, therefore, in a large town, they might expect a good deal of variation in that way. In a better-class house there was a markedly different demand from that shown in the paper. Another possible source of revenue was in the heating of churches. At the present time it was done with coke, and it sometimes took a long time and half a ton of fuel to warm the church, whereas electric radiators would do all that was necessary in a few hours. The comparative costs of the various types of equipment were one reason why electric heating was not more popular.

Mr. P. F. Allan declared that the opposition to the use of electricity was lessening, and there was not so much complaint as to the higher charge when compared with gas. Design should be closely considered; they had a new mode of heating, and must produce new apparatus suitable for the purpose for which it was intended. They should not slavishly follow the types that had been adapted for gas or coal use. Another use for electric heating was the heating of prisons; it had been used in many other cases. They could not put ordinary heating apparatus in prison cells, so they were forced to circulate hot air, and this had been done satisfactorily with electrical apparatus.

Mr. Schuil spoke of the difficulty often experienced in getting a supply of electricity, and said once when he applied for a supply he was informed that it would cost him £70 in respect of the cable. Glasgow had adopted a scheme to treat heating by itself, and by distributing it at a low cost and by encouraging the use of electricity in the house they were doing everything possible to induce consumers to use it. Amsterdam, he understood, had the best heating load in Europe.

Mr. A. G. Shearer regretted that the author had not referred to a supply of hot water. In many installations more energy was wasted than was used because of the manner in which the installation was arranged. Those going in for domestic load should get rid of coal fires and adopt a proper scheme.

Mr. P. W. Ward thought a better diversity of load might be obtained than was shown in the diagrams in the paper. If an article on hire went wrong it was at once put right, whereas if it were privately owned it was often allowed to continue defective.

Mr. T. Carter thought that the whole question as to the extended use of electricity was one of cost. It was all very well to say that houses should be electrically equipped, but what was it going to cost and, if installed, were consumers going to get any real benefit? Those were points upon which the paper did not enlighten them.

Others who took part in the discussion were: Messrs. W. Lampbourne, T. W. Muncaster, W. A. Royle, and A. W. Crompton.

Mr. W. A. Gillott, in his reply, said that several of the speakers had missed the real point of the paper. It was a commercial paper, and was meant to deal with the commercial, not the technical, aspect of the question.

THE NEW COLWYN BAY SYSTEM.

On November 30th the Colwyn and Colwyn Bay District Council celebrated the inauguration of the bulk supply from the North Wales Power Co.'s Dolgarrog works. The ceremony was one of peculiar interest inasmuch as Colwyn Bay is the first local authority in the North Wales area to be supplied by the North Wales Power Co., whose undertaking has been adopted by the Electricity Commissioners for the supply of electricity in bulk throughout the whole of the North Wales Electricity District, which comprises the six northern counties of Wales and part of the border counties of Cheshire and Shropshire.

The power company has two generating stations, one at Dolgarrog situate in the Conway Valley, and another at Cwm Dyli, from which it can guarantee an unlimited supply to local authorities within the area. The Colwyn Bay Council has constructed a new station on the site of the old works. The current is supplied at a pressure of 34,600 V to a central sub-station at Bronynant, where it is reduced to 6,600 V pressure and transmitted to a converter station situated in the centre of the town. In the top floor of the sub-station are fixed the 35,000-V switch cubicles to control the incoming overhead 3-phase transmission lines. There are three incoming 35,000-V feeders, two from Dolgarrog and one which will link through to the Conway sub-station and beyond, thus providing two alternative sources of supply. The e.h.p. switchgear was supplied by Messrs. Ferguson, Pailin, Ltd., of Manchester, and consists of four sheet steel cubicles containing the necessary isolating switches, oil-break main switches, bus bars, &c. Three cubicles are arranged to control the incoming outgoing feeders; the fourth controls the supply to the two 1,000-kVA transformers through a set of bus bars with selector switches.

The 6,600-V switchgear was also supplied by Messrs. Ferguson, Pailin, and is of their standard truck type.

Provision is made for installing three 1,000-kVA main transformers, but at present two only are installed. These transformers, supplied by Messrs. Ferranti, Ltd., are of the oil-immersed, self-cooled, 3-phase type, with boiler-plate tanks, fitted with radiating tubes. Each transformer steps down from 34,600 to 6,600 V, with 5 per cent. plus and minus tappings. The transformers are delta connected for operating as at present at 20,000 V primary, and later will be connected star on 34,600 V when the line pressure is increased.

. The feeders to the new distributing station are laid in duplicate, being 0.1 sq. in. copper, paper-insulated, lead-covered, and steel tape armoured cables, laid direct in the ground. This contract was carried out by Mesrs. W. T. Glover & Co., Ltd., of Manchester.

The distributing station is designed for an ultimate capacity of four converting sets of 500 kW each. (The capacity of the old steam station was 540 kW.) The system of supply in Colwyn Bay is 3-wire d.c. at 220/440 V. The conversion machinery adopted comprises motor converters, supplied by Messrs. Bruce Peebles & Co., Ltd. There are two 125-kW converters, one of 300 kW, and one of 500 kW, operating at 750 r.p.m.

The extra high-pressure switchgear is Messrs. Reyrolle's draw-out armour-clad type switchgear in two parts, interconnected by a bus bar section switch, and comprises: Two feeder panels with interconnecting switch between and four machine panels. Murday recording voltmeters are mounted above the interconnector unit. Each feeder unit is complete with overload relay on each phase. The machine units are complete with 250-A switches with overload and no-volt relays, with time limit fuse. Merz-Price protection gear is fixed on each machine cable.

The low-pressure switchgear was supplied by Messrs. Bertram Thomas, of Manchester. The d.c. board comprises: Four generator panels, one spare generator panel for extension, one summation panel and four feeder panels for eight feeders.

The generator panels are equipped with plugs and shutter interlocks for either traction or lighting in place of throw-over switches, and with bus bars throughout for either load.

The mountings of each panel comprise negative, equaliser, and neutral switches of heavy knife pattern, at the bottom of the board, and positive breaker at the top. The whole of the switches are of the full rated capacity of the machine on circuit.

The summation panel is mounted with indicating ammeter for each circuit of the 3-wire system, one ammeter to indicate balance of system, recording voltmeters, recording ammeter, and watt-hour meters for registering the output.

Each feeder panel is mounted with double-pole breakers for a feeder at top and bottom, with indicating ammeters to each pole of each feeder in centre.

The capacities of the panels are:—Two feeders of 500 A each; two feeders of 250 A each; two feeders of 250 A each; one feeder of 200 A; one feeder of 100 A.

The panels can be brought up to 500-A capacity each when necessary.

After the converters had been set in motion the company adjourned to the Council Chamber where light refreshments were served. Mr. Hugh Hughes, J.P., chairman of the Council, presided, and he was supported by Lord Colwyn, Mr. Henry J. Jack, managing director of the North Wales Power Co., Councillor J. J. Price, chairman of the Electricity Committee, and others.

Radium from Madagascar.—Some two years ago French inhabitants of Madagascar drew attention to the fact that Madagascar was rich in radioactive minerals. Experts were sent to prospect, and found that the Manandona region was rich in ufanite (uranium phosphate), and that uranium oxide was found in the Ankaratra district. The working of these deposits has been begun, and last year nine tons of uranium oxide were exported. Eighteen tons will leave Madagascar this year, and it is hoped that in the near future the island will be able to supply half the quantity of radium produced in the world.—*Reuter* (Paris).

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY FOR OCTOBER, 1922.

The October returns of electrical export and import business show considerable increases as compared with the September figures. Electrical exports reached £1,008,281, an increase of £230,274 as compared with the previous month, but a decrease of £202,342 as compared with October, 1921. Electrical imports for October totalled £217,092, an increase of £16,160 on September, 1922, and £84,181 on October, 1921.

The electrical re-export figures for the month were £11,092, an increase of £678 on the September total, but a decrease of £11,810 on October, 1921.

For the ten months ended October 31st the total weight of electrical machinery exports was 13,953 tons, as compared with 15,336 tons for the same period in 1921.

Below will be found a table showing the values of electrical exports and re-exports for the month, with increases or decreases for each item as compared with the months of September, 1922, and October, 1921.

Values of Electrical Exports, Imports and Re-Exports for October, 1922, and Comparisons with September, 1922, and October, 1921.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct. 1922.	Inc. or dec. as compared with Sep., 1922.	Inc. or dec. as compared with Oct., 1921.	Electrical imports for Oct., 1922.	Inc. or dec. as compared with Sept., 1922.	Inc. or dec. as compared with Oct. 1921.	Electrical re-exports for Oct., 1922.	Inc. or dec. as compared with Sept., 1922.	Inc. or dec. as compared with Oct., 1921.
Electrical goods and apparatus.	£128,846	+£28,935	−£8,658	£57,16	+£20,293	+£19,541	£3,064	+£293	−£1,488
Insulated wires and cables ...	167,714	+ 42,174	−103,418	33,180	+ 7,643	+20,040	98	+ 48	+ 14
Glow lamps	30,343	+ 1,840	+ 7,457	20,611	+ 6,236	+ 3,889	800	−305	− 2,875
Arc lamps and parts	175	− 518	− 135	989	− 806	+ 674	439	− 274	+ 150
Batteries and accumulators ...	68,532	+ 24,518	+ 25,674	19,758	+ 1,145	+13,605	—	+450	− 1,116
Meters and instruments ...	30,713	+ 10,873	− 5,798	5,460	+ 227	+ 2,639	1,125	+286	− 2,544
Carbons	8,243	+ 1,552	+ 4,515	6,300	+ 5,128	+ 2,563	327	−151	− 338
Electrical machinery, railway and tramway motors ...	24,089	+ 4,605	+ 20,969	—	—	—	—	—	—
Other motors and generators...	132,582	+ 14,968	− 45,719	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	10,467	+ 1,504	− 8,773	121	+ 121	− 67	—	—	—
Electrical machinery, unenumerated	149,385	+ 32,618	+ 14,379	44,538	−26,976	+16,651	3,955	−290	− 4,292
Telegraph and telephone cable and material, telegraph and telephone wires and cable (not submarine)	73,399	+ 42,581	− 72,473	2,098	+ 101	− 2,277	—	—	—
Submarine telegraph and telephone cable	36,467	+ 31,513	+ 27,094	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	147,326	− 6,889	− 57,456	26,877	+ 2,978	+ 6,856	1,284	−383	+ 679
Totals	£1,008,281	+£230,274	−£202,342	£217,092	+£16,160	+£84,181	£11,092	+£678	−£11,810

PARLIAMENTARY NOTES.

[By our Special Parliamentary Reporter.]

Schemes to Relieve Unemployment.—On November 30th, in reply to the Labour Party's amendment to the Address with regard to unemployment, Sir M. Barlow, Minister of Labour, outlined the Government's proposals for alleviating the evil. Referring to relief work, he said that the Post Office would be able to put in hand rapidly work dealing with the laying of cables. This would mean some £650,000 worth of work, and, with other similar schemes, the Post Office proposals totalled about £1,000,000. This would provide work for large numbers of men in digging operations, and also for skilled craftsmen in factories on electrical plant, cables, &c. The Government was also making grants for road works, and, in addition, the Trade Facilities Act would be renewed for another twelve months and the maximum of capital in respect of which guarantees might be given would be increased from £25,000,000 to £50,000,000. The Exports Credits Scheme would be extended to the existing limit of £26,000,000. Turning to the railways, he said that, at the request of the Prime Minister, the railway companies were prepared to expedite their programmes of development. The various companies had informed the Government that they had in hand, or could speedily undertake, programmes of work, which would involve the following expenditure:—North-Western and Midland Railways, £2,000,000; Great Eastern, £1,000,000; Great Western, £1,000,000; London & South-Western, £1,000,000.

In addition, schemes involving between £1,000,000 and £2,000,000 more were in contemplation, and the companies had further assured the Government that, as the grouping proceeded, they would be able to launch further development work.

Still more important, perhaps, than all these works were the proposals of the new Southern group for electrification. The chairman-elect had promised, not only to press on with the electrification of the South-Eastern & Chatham Railway suburban area, but also to extend the electrification of the London, Brighton & South Coast and the London & South-Western Railways.

The Electricity Commissioners had reported proposals for new power stations, or large extensions of existing power stations, at Barking, Deptford, Stourbridge, Ferry Bridge, Agecroft, Preston, and Nottingham. The Grampian Electric Power Co. had an Act empowering it to construct large works on the River Tay. All these schemes would, between them, involve operations on a very large scale, totalling something like £10,000,000, while, in addition, there would in every case be the work on the construction and laying of new transmission lines and cables providing a good deal of additional employment.

It was satisfactory to read of contracts for the electrification of railways in South Africa being secured by a British firm, and for the supply of railway wagons in India secured by another. Even from the Clyde came reports of contracts for the steel trade, and furnaces in the North which had been idle for the last two years were re-starting.

Midland Railway Electrification.—On November 29th, Mr. W. Thorne asked when the electrification of the Midland line to Tilbury and Southend would begin. Col. Ashley replied that the railway company was not in a position to make any definite proposals. In any case, the Ministry of Transport had no compulsory powers.

Telephones in Rural Areas.—On November 30th Mr. Millar asked the Postmaster-General if he could state the terms on which new telephone exchanges were now being opened in rural areas and the present tariff and rates for rural party lines.

Mr. N. Chamberlain replied that new exchanges were being provided in rural areas at an installation rental of £2 a quarter per circuit, within a mile of the exchange, provided that at least eight subscribers were forthcoming and the cost was not abnormally high. If 15 subscribers could be found the normal tariff charges applied. These terms covered a day service only, but it was often possible by a party line arrangement to extend the subscribers' circuits at night to an exchange open always, subject to a payment of 5s. a quarter. Party lines were provided at a charge of £1 or £1 2s. 6d. a quarter per station where there were three or two subscribers respectively per mile of line beyond a radius of half a mile from the exchange.

Mr. N. Chamberlain, in reply to Commander Bellairs, said that old military telephone systems in rural areas were being used as far as possible for the public service.

Overhead Lines.—In reply to Sir Wilfred Sugden, Col. Ashley said that permission to transmit electricity by overhead lines was invariably given to authorities which established a good case for this system.

Special Orders.—On November 30th a number of Special Orders, made under the Electricity (Supply) Acts, 1882 to 1922, were approved.

Great Northern Railway.—On December 4th Col. Ashley, replying to Col. Newman, said that no scheme regarding the electrification of the suburban lines of the Great Northern Railway was at present before him.

ELECTRICAL CHRISTMAS GIFTS.

The annual problem of the suitable Christmas present is once again in evidence, but to those in the electrical industry the question should, by this time, be easy of solution. Those who would break away from the hide-bound tradition forced upon them by vendors of "specialised" Christmas gifts, and at the same time help to build up the industry by encouraging the domestic consumer, cannot do better than purchase electrical appliances. It is safe to say that, at the present day, electrical gifts present as wide a field of choice as can be desired, both as regards cost and variety. They range from the humble pocket lamp to the elaborate cooking range, disregarding such side lines as electrically-operated grand pianos, or radio sets "*de luxe.*"

In this page we endeavour to stimulate the electrical Christmas gift "idea" by presenting a selection of possible presents, but considerations of space necessarily limit our choice.

If radio sets are required, we would refer readers to our issues of October 6th, 13th, and 20th, when a variety of equipment was described in connection with the recent Wireless Exhibition.

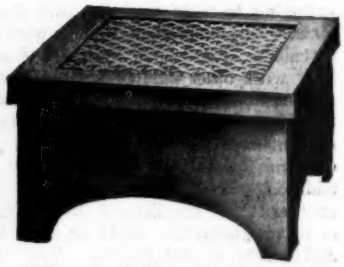
Plate warmer (Metropolitan-Vickers Electrical Co., Ltd.), of handsome appearance, nickel steel, highly polished. Consumption 100 W.

"Baby Revo" iron (Cable Accessories Co., Ltd.). Weight 4 lb., loading 250 W. Nickel-plated finish.

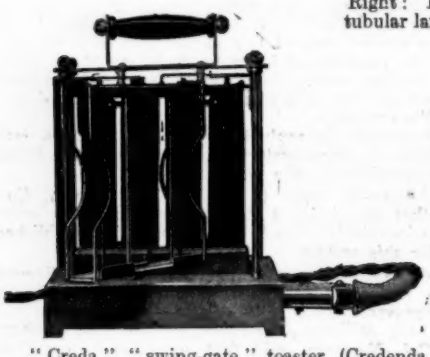
2-kW "Cosmos" radiant fire (Metropolitan-Vickers Electrical Co., Ltd.), "Empire" period design, finished in oxydised copper or silver.

"Jeames" dumb butler (Berry's Electric, Ltd.). Reading lamp, cigar-lighter, ash tray, &c. Overall height 36 in.

Two examples of decorative lighting (Messrs. Ward and Goldstone, Ltd.). Left: A china-glass reading or table lamp with silhouette design. Right: Parrot in natural colours, with small tubular lamp in interior.



"Revo" boiling plate, of plain design (Cable Accessories Co., Ltd.). Top, 8 in. square; loading 750 W. Black enamel or grey porcelain enamel finish.



"Creda" "swing-gate" toaster (Credenda Conduits Co., Ltd.). With revolving bread racks, nickel plated, 500-W element.

"Magnet" pedestal heater (General Electric Co., Ltd.).

"Creda" saucepan (Credenda Conduits Co., Ltd.). Copper or nickel plated. Two 200-W elements. Weight 1¼ lb.

"Universal" tea pot (Messrs. L. G. Hawkins & Co., Ltd.), equipped with nickel-plated tea ball-infuser. Nickel-plated, 420-W loading, weight 4 lb.

"Creda" shaving pot (Credenda Conduits Co., Ltd.). Capacity ½ pt., 150-W element, weight 1 lb. Copper or nickel plated.

"Cosmos" kettle (Metropolitan-Vickers Electrical Co., Ltd.). Polished or nickel-plated copper. Loading 700 or 1,050 W. Weight 2¾ or 4¼ lb. Two or three pints capacity.

"Universal" electric grill (Messrs. L. G. Hawkins & Co., Ltd.). Nickel plated, "ebonised" handles. Three-heat snap switch. Three cooking pans of varying depths, 8 in. diameter.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-Western Centre Chairman's Address.—*Abstract.*

The opening meeting of the 1922-23 session of the North-Western Centre of the Institution was held on November 14th, at Manchester, when Mr. A. S. Barnard, the chairman, delivered his inaugural address. He said he liked to think that in electing him some members had in mind that it was time the rank and file of the Institution received some official recognition. However useful the large consumer was to an electricity supply undertaking, the backbone was the immense number of comparatively small users. So also with the Centre. There was a list of comparatively small lines of electrical engineering of interest to a particular class, two or three of which subjects could be dealt with briefly at an informal meeting. Cheap generation and distribution were not the only matters which the Institution must consider. He would like to see some of the informal meetings devoted to discussions, not only on theory and design, but also on working experience in the lesser lines.

Why was it that they still had gas-lighted passenger trains in Great Britain? So far as he was aware, it was not even necessarily installed in new rolling stock. Wiring contractors should take part in the discussions and not leave it entirely to consulting engineers and theorists to determine what was good practice. The final authority in these matters was the user, who paid the bill. If wiring was made too expensive by elaborate specifications and regulations there would be less wiring done, but if they tolerated inefficient and shoddy work it would be of little use to build super-power stations and offer cheap energy. Contractors had as big a responsibility in the matter of wiring practice as plant manufacturers and central station engineers.

Attention should be paid this year to the important work that was being done by electrical engineers in collieries. The smoke-clouds of Manchester and the neighbouring towns were responsible for a tremendous waste of energy, but when they had attained the "All-electric Age," they might hope to have flowers to pick and to be able to pick them without dirtying their hands. One branch of agriculture seemed to him to offer a promising field for research. If seed potatoes could be rendered immune from wart disease by electrical treatment it would be an immense boon. Herefordshire, while interesting farmers in electricity, showed the bearing that side lines might have upon the larger problems of public electricity supply. The supply of electricity for power purposes was originally a side-line, and not too hopeful a one in the view of very many people. Electrification of the railways would benefit the nation. Surely it was up to the members of the Institution to educate public opinion in the matter. The matter would advance more rapidly if the electrical engineer could make a decided and authoritative pronouncement as to what should be the system to adopt throughout the main lines of the British railways. The Electrical Development Association might usefully devote some of its energy and resources to cultivating public opinion and creating a more insistent demand for this reform.

Early installations had in many cases left a legacy of a d.c. network of mains, and the question arose whether there was any justification for their survival. But a plebiscite of consumers—if it were possible to get any response to a questionnaire on the subject—would show an overwhelming majority of power users in favour of alternating-current supply, but an equally overwhelming majority of private users, shopkeepers, and residents who favoured direct-current. A justification for the latter could be found in the possibility of holding a little in reserve in a way which was practically impossible with alternating current. Linking up with one's neighbours was a very real safeguard to continuity of supply, but the conditions which upset one user's supply might easily affect his neighbours'. A few thousand kilowatts in a storage battery at a sub-station, instantly available, might easily convert what would otherwise have been a serious interruption or curtailment of supply into a slight irregularity, which would pass unnoticed by the majority of the consumers. There were commercial limits to the value of storage, but in the past some failures to meet obligations to the consumer had been due to an over-zeal for economy. Take these figures for a large station: Total kWh sold, 137,000,000; maximum demand, 67,100 kW; load factor, 23.29 per cent.; total works' cost, 1.73d. per kWh. Was it not conceivable that, with a really comprehensive system of storage, bringing the load factor up to 50 or 60 per cent., the works-cost could be brought down to 1.23d. per kWh, a gross saving in round figures of £250,000 per annum? The maximum load of 67,000 kW might be regarded as plant having a capacity of 32,000 kW running at 50 per cent load factor, and a further 35,000 kW capacity running idle all the time. Storage that could take charge of 35,000 kW for (say) two hours per day would in all probability be amply sufficient to ensure that the running plant necessary to meet the maximum demand would work year in and year out at a load factor of 50 per cent. Battery sub-stations to provide this storage would cost somewhere about a million pounds. 35,000 kW of reserve energy for two hours was a consideration not to be ridiculed, even if the battery losses and maintenance costs would eat a big hole in the quarter of a million pounds per annum saved by improved load factor.

Another thing which concerned them as an Institution was the qualification of the electrical contractor. Shoddy work brought discredit on the industry and the whole profession. With the introduction of little petrol-driven domestic lighting sets "motor and electrical engineer" was becoming as common a sign as "plumber and electrician." He saw no reason why a plumber or a motor mechanic should not be a reliable electrical contractor providing he qualified himself for the work. Until a system of national registration of electrical engineers had been evolved a vulnerable point was exposed to the attacks of those who worked for immediate returns in hard cash without regard to the effect of their work on the industry as a whole. Any such system would have to include the registration of master contractors as well as of wiremen and electrical mechanics. Were it merely a question of workmanship on the part of the wireman the matter might safely be left to the trade unions concerned, but of course scamped work was as liable to originate in the office as on the job.

The electricity supply industry was to be congratulated on the thorough-going manner in which it had adopted the system of Whitley Councils. The principle might, with advantage, be extended and applied to the relations between buyers and consulting engineers, on the one hand, and manufacturers and contractors, on the other.

Dr. Marchant warmly commended the policy of establishing sub-centres, such as Liverpool. In many places the electrical industry had become somewhat specialised, and was concerned with what had been termed side lines. It seemed to him desirable that the sub-centres should pay particular attention to those subjects.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 28, High Holborn, London, W.C. 1.

31,506. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 17th. (United States, April 17th.)
31,528. "Carrier for electric cable." A. J. Bright. November 18th.
31,531. "Threaded cable connector." G. S. Wilson. November 18th.
31,545. "Thermionic valves." H. V. Whitehouse. November 18th.
31,551. "Electric generators or motors." J. H. Jones, T. R. O'Keefe, and J. L. Turner. November 18th.
31,558. "Electric couplings." W. E. Shuttleworth. November 18th.
31,559. "Electric signalling device." W. E. Shuttleworth. November 18th.
31,582. "Ignition apparatus for internal-combustion engines." Rolls-Royce, Ltd., and F. H. Royce. November 18th.
31,589. "Ignition plugs for internal-combustion engines." G. H. Negus. November 18th.
31,594. "Dynamo-electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. November 18th.
31,601. "Electric cables." W. F. Bishop and W. T. Henley's Telegraph Works Co., Ltd. November 18th.
31,615. "Control of trains." A. R. Angus. November 18th.
31,634. "Thermionic valves." C. V. Morris. November 20th.
31,635. "Notching or punching core-plates for dynamo-electric machines." A. E. Cooper. November 20th.
31,641. "Spark-plug cleaner case." R. Hayward. November 20th.
31,642. "Electric lighting." H. Cramer. November 20th.
31,667. "Telephone receivers." A. C. Brown. November 20th.
31,672. "Luminous signs." L. Guerbois. November 20th.
31,674. "Electric compressor." E. F. A. C. Leperre. November 20th. (Belgium, April 24th.)
31,675. "Wind-driven electric generators." W. Henderson and Telford, Grier & Mackay, Ltd. November 20th.
31,682. "Thermally-actuated electric switches." C. French and R. French. November 20th.
31,689. "Method of heating materials and electric furnace therefor." I. Kennerfelt. November 20th.
31,693. "Wireless valves, thermionic rectifiers, &c." W. H. Hitchcock and A. E. Katz. November 20th.
31,697. "Device for practising interpretation of audible Morse code signals." P. B. Down. November 20th.
31,705. "Electrolytic rectifiers or condensers." M. A. Codd. November 20th.
31,706. "Impregnating coils." British Thomson-Houston Co., Ltd. (General Electric Co.). November 20th.
31,710. "Mercury watt-hour meter." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. November 20th. (France, December 3rd, 1921.)
31,711. "Single-stroke bells for railway signalling." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. November 20th.
31,727. "Electric light fittings." B. J. Grigsby. November 20th. (United States, December 29th, 1921.)
31,770. "Magnetic talking, dictating, &c., machines." Telegraphie Ges. System Stille. November 21st. (Germany, December 10th, 1921.)
31,779. "Radio-frequency electron-tube amplifiers." A. J. H. Haddan (Radio Instrument Co., Inc.). November 21st.
31,784. "Apparatus for displaying illuminated advertisements, &c." G. Nattero. November 21st.
31,790. "Inter-valve transformers for wireless telegraphy, &c." E. Harberd. November 21st.
31,792. "Electrically-operated flow meters." E. H. Freeman. November 21st.
31,800. "Controller switches for electric motors." S. Parsons. November 21st.
31,809. "Electric plug." Pacent Electric Co., Inc. November 21st. (United States, December 5th, 1921.)
31,827. "Electric railways and tramways." G. R. P. Wheatley. November 21st.
31,833. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. November 21st. (United States, April 10th.)
31,835. "Electrical fittings." S. H. Groom. November 21st.
31,847. "Regulation of voltage in conductor systems." P. C. Rushen (Siemens Schuckertwerke). November 21st.
31,859. "Electric switches for dimming headlights, &c." H. J. Osborn. November 22nd.
31,866. "Electric heater and drying device." A. R. Brierley. November 22nd.
31,868. "Combined electric switches and couplings." J. A. Crabtree. November 22nd.
31,871. "Electric locomotives, &c." R. K. Hill. November 22nd.
31,885. "Electric drop lamps." D. A. Ellam. November 22nd.
31,895. "Self-contained inert cell." I. Jascourt, H. D. Pattinson, J. Rose, and Seal Co. (London), Ltd. November 22nd.
31,896. "Disinfector for telephones." I. Jascourt, H. D. Pattinson, J. Rose, and Seal Co. (London), Ltd. November 22nd.
31,926. "Electrically-propelled invalid's tricycle." J. & A. Carters, Ltd., and E. G. Payne. November 22nd.
31,931. "Spark plugs." A. W. Bodin. November 22nd.
31,932. "Electric switches." W. T. Gray, Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. November 22nd.
31,935. "Electrolytic iron." F. A. Eustis. November 22nd.
31,936. "Electrolytic iron." F. A. Eustis. November 22nd.
31,941. "Manufacture of electric discharge devices." C. G. Eden and General Electric Co., Ltd. November 22nd.
31,942. "Manufacture of lamp mounts, &c." British Thomson-Houston Co., Ltd. November 22nd. (United States, November 25th, 1921.)
31,955. "Ignition apparatus for internal-combustion engines." H. W. F. Ireland and J. Lucas, Ltd. November 22nd.
31,984. "Automatic control of electric motors." L. Backhouse, Electro-Mechanical Brake Co., Ltd., and A. W. Maley. November 22nd.
31,985. "Variable inductances." A. White. November 22nd.
32,003. "Electric welding." Rose Street Foundry and Engineering Co., Ltd., and R. F. V. Walsh. November 23rd.
32,008. "Method of winding coils for electrical machines." Ateliers de Construction Electriques de Charleroi. November 23rd. (Belgium, December 6th, 1921.)
32,026. "Combined switch and rheostat for controlling filaments of thermionic valves." F. H. Blaxley. November 23rd.
32,047. "Rectifying devices." A. R. Angus. November 23rd.
32,048. "Crystal detectors for wireless." F. Gaillard. November 23rd.
32,058. "Apparatus for receiving wireless signals." S. Y. White. November 23rd.
32,065. "Electrically-illuminated signs, &c." J. Bacon. November 23rd.
32,067. "Starters for motor vehicles, &c." V. F. Feeny (J. T. Burnip). November 23rd.
32,075. "Electric discharge apparatus." E. H. Hanson and H. Kennedy and Co., Ltd. November 23rd.
32,081. "Electric battery lamps or lanterns." G. A. H. Wootton. November 23rd.
32,093. "Rheostats." A. K. E. Strathdee. November 23rd.
32,101. "Illumination signs, &c." J. I. Hall. November 23rd.
32,116. "Terminals for insulated electric conductors." H. Warren and W. T. Warren. November 23rd.
32,123. "Receivers for wireless broadcasting apparatus." G. H. Champ and Champ, Kay & Co., and G. E. O. Kay. November 24th.
32,130. "Head lamps for road vehicles." P. Ross. November 24th.
32,140. "Diaphragms for telephones, microphones, &c." F. H. Alston. November 24th.
32,141. "Safety lid for electrically-driven mixing machines, &c." W. Daniels, W. J. Fowler, E. Hickey and P. W. Tully. November 24th.
32,143. "Induction coils for wireless receiving apparatus." J. V. Rushton. November 24th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

15,544. "Miners' safety lamps." E. A. Hailwood. June 6th, 1921. (188,301.)
18,138. "Shock-proof accumulator case." S. Trench and G. W. Brown. July 5th, 1921. (188,330.)
18,219. "Aircraft lamps." A. L. Davis. July 5th, 1921. (188,357.)
20,457. "Method of increasing the output of gas from electrolytic apparatus." E. Vesme. July 29th, 1921. (188,370.)
20,593. "Gramophones, phonographs, and the like." British Thomson-Houston Co., Ltd., and A. P. Young. August 2nd, 1921. (188,371.)
21,026. "Recording apparatus for electric current impulses." British Thomson-Houston Co., Ltd. (General Electric Co.). August 8th, 1921. (Addition to 130,762.) (188,391.)
21,280. "Means for regulating the strength of electric currents." C. S. Agate and A. E. Hill. August 10th, 1921. (188,400.)
21,582. "Electric light fitting." J. Hall. February 3rd, 1922. (188,407.)
22,355. "Electric distributing systems." N. Togami. August 23rd, 1921. (188,418.)
22,584. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 3rd, 1920. (168,597.)
23,034. "Circuit closers for electrically-operated alarm mechanisms of the thief or burglar type." G. W. Wacker. August 30th, 1921. (188,430.)
23,710. "Electric fires or radiators." J. A. Orange and Metropolitan-Vickers Electrical Co., Ltd. September 6th, 1921. (188,439.)
24,333. "Sealing of electric conductors in glass or the like." H. G. Cameron and Metropolitan-Vickers Electrical Co., Ltd. September 13th, 1921. (188,447.)
24,352. "Electrically-driven lifting-gear." E. C. R. Marks (Siemens Schuckertwerke Ges.). September 13th, 1921. (188,448.)
24,466. "Apparatus for and methods of making silica glass." British Thomson-Houston Co., Ltd. (General Electric Co.). September 14th, 1921. (188,451.)
24,984. "Electrical resistance board or panel for tandem lamp circuits." B. B. Gascoyne. September 21st, 1921. (188,465.)
25,014. "Mounting of electric conductors in casings." F. Krupp Akt. Ges. February 10th, 1921. (175,239.)
25,041. "Electric relay devices." G. A. Cheetham, W. Smethurst, and Metropolitan-Vickers Electrical Co., Ltd. September 21st, 1921. (188,466.)
25,062. "Receiving devices for electric waves." F. Schneider. July 13th, 1921. (183,104.)
25,192. "Searchlights." C. Zeiss (firm of). September 24th, 1920. (169,457.)
25,388. "Systems of and apparatus for electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). September 24th, 1921. (188,471.)
25,801. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). September 29th, 1921. (188,476.)
25,811. "Filament lamps for vehicles." Siemens Bros. & Co., Ltd., and A. C. Whitehead. September 29th, 1921. (188,477.)
26,220. "Radio-telephone transmitter." H. S. Walker. October 4th, 1921. (188,483.)
26,892. "Electrical signalling systems employing high-frequency carrier waves." Western Electric Co., Ltd. (October 11th, 1920.) (170,286.)
27,283. "Electric irons." T. D. Finizio. October 14th, 1921. (188,495.)
27,883. "Radio-signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). October 20th, 1921. (188,505.)
28,087. "Starter transmission gear and dynamo drive combined." J. B. Bignamy. October 22nd, 1921. (188,507.)
28,452. "Electric switches or circuit-breakers." British Thomson-Houston Co., Ltd. (General Electric Co.). October 26th, 1921. (188,513.)
28,927. "Electric water-heaters." H. E. P. Baden and Electro-Heater Co. Inc. October 31st, 1921. (188,518.)
30,114. "Alternating current electric instruments for indicating synchronism, power factor, phase difference, or the like." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. November 11th, 1921. (Addition to 162,471.) (188,532.)
30,153. "Tapping switches for changing voltage ratios of transformers or the like." S. A. Stigant, O. E. Scase, and Johnson & Phillips, Ltd. November 11th, 1921. (188,533.)
30,293. "Sparking plug." E. de Waele. November 14th, 1921. (188,534.)
31,509. "Method of applying magnetic material to electrical conductors." Western Electric Co., Ltd. December 8th, 1920. (172,619.)
32,067. "Systems for transforming the frequency of electric currents." W. Dornig. November 30th, 1921. (188,551.)
32,890. "Headlights and the like." F. G. Piper. December 7th, 1921. (188,559.)
35,166. "Mercury vapour apparatus, and more especially quartz lamps." Quartzlampen Ges. December 31st, 1920. (173,529.)

1922.

350. "Current collectors for electrically-driven vehicles." C. B. Buchanan and C. C. Johnson. January 5th, 1922. (188,583.)
1,770. "Electrical protective relay apparatus." Metropolitan-Vickers Electrical Co., Ltd. January 20th, 1921. (174,359.)
1,981. "Devices for indicating the failure of electric lamps." Westinghouse Brake & Saxby Signal Co., Ltd. August 24th, 1921. (185,084.)
3,009. "Sealing of the ends of electric cables." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. February 1st, 1922. (188,595.)
4,463. "Electrical speed regulator systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). February 15th, 1922. (188,603.)
8,354. "Automatic electric motor starters." British Thomson-Houston Co., Ltd. (General Electric Co.). March 22nd, 1922. (188,613.)
8,808. "Stand for Röntgen tubes or the like." Reiniger, Gebbert & Schall Akt. Ges. March 26th, 1921. (177,545.)
9,084. "Telephone mufflers." L. S. Scher. April 21st, 1921. (178,815.)
16,081. "Electric ignition devices for internal-combustion engines." Skywing Aircraft Corporation. December 1st, 1920. (Divided application on 172,308.) (181,374.)
16,249. "Telephone exchange systems." G. C. Snijders. June 14th, 1921. (181,709.)
16,268. "Electric ignition devices for internal-combustion engines." Skywing Aircraft Corporation. December 1st, 1920. (Divided application on 172,308.) (181,387.)
28,386. "Electric plug-and-socket unions for lamps." A. L. Davis. July 5th, 1921. (Divided application on 188,357.) (188,624.)
28,389. "Aircraft lamps." A. L. Davis. July 5th, 1921. (Divided application on 188,357.) (188,625.)